

4K91-17

KODIAK MANAGEMENT AREA
SALMON RESEARCH OPERATIONAL PLANS
FOR 1991

Regional Information Report¹ No. 4K91-17

Alaska Department of Fish and Game
Division of Commercial Fisheries
211 Mission Road
Kodiak, Alaska 99615

June 1991

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OPERATIONAL PLAN

1991

KODIAK MANAGEMENT AREA

CATCH SAMPLING

Alaska Department of Fish and Game
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INTRODUCTION

The Kodiak Management Area extends from Imuya Bay on the south to Cape Douglas on the north and includes Shelikof Strait and the waters of Kodiak, Afognak, and Shuyak Islands (Figure 1). The area includes 454 specified salmon streams and lakes. The management area is divided into nine districts and 98 statistical areas. The districts and statistical areas are established to facilitate specific stock management.

Five Pacific salmon species are harvested in the Kodiak Management Area. Sockeye salmon are economically the most important species followed by pink, chum, coho, and chinook salmon. The 1990 catch was 5,248,000 sockeye, 5,984,000 pink, 578,000 chum, 294,000 coho, and 19,000 chinook salmon. The total harvest was 12,122,000 fish. The 1991 harvest is projected to be 4,300,000 sockeye, 230,000 coho, 20,500,000 pink, 805,000 chum and 15,000 chinook salmon.

The Alaska Department of Fish and Game assumed the responsibility of managing Alaska's salmon resources in 1960. The goal has been to manage the resource for maximum sustained yield. Generally, achievement of this goal is accomplished by: 1) evaluation of escapement magnitude by system which will allow for maximum sustained yield and; 2) deriving techniques necessary to assist management of the fishery in obtaining escapement goals and optimizing harvest. Assignment of catch to river system of origin is a prerequisite for evaluating escapement goals and forecasting stock returns. In 1985 an expanded salmon commercial catch sampling operation was initiated in the Kodiak Management Area for establishing a data base for determining stock contribution levels, evaluating escapement goals, and forecasting. The program has continued since. The current emphasis is on sockeye and chum salmon.

OBJECTIVES

Long Term

Improved management of the salmon resources for the Kodiak Management Area through enhanced precision of forecasting, development of stock-recruitment relationships for assessing escapement requirements, and accurate determination of stock composition estimates for mixed stock fisheries.

Short Term

- a.) Collect representative age composition data of the sockeye and chum salmon catches from selected fisheries.
- b.) Collect representative sockeye scales from selected fisheries, including the North Shelikof Strait fishery, for stock separation studies.

SUPERVISION

Pat Holmes will supervise the catch sampling at the Port of Kodiak, while biologist Charlie Swanton will supervise the Lazy Bay catch sampling and the Moser Bay test fishery.

PERSONNEL

Personnel assignments at Lazy Bay and the Port of Kodiak are defined in Table 1. Available permanent and seasonal staff will assist in catch sampling at the Port of Kodiak.

Table 1. Salmon catch sampling crew for Kodiak Management Area, 1991.

Location	Name	Title	PCN	Position	Period
Port of Kodiak	Patrick Holmes	FB II	1273	Crew Leader	June 9 - Aug 31
	Lief Brockman	FT I	1760	Catch Sampler	June 9 - Aug 21
Lazy Bay	Leslie Scott	FB I	1413	Crew Leader	June 9 - Aug 31
	Chris Hicks	FT III	1760	Catch Sampler	June 9 - July 15

PROCEDURES

Catch Sampling

The sockeye and chum salmon catches will be sampled for age, length, and sex (ALS) by the crew at the Port of Kodiak and at Lazy Bay according to the schedules in Tables 2 and 3.

All catch sampling data are to be representative and random. To ensure that this occurs mixed loads from non-targeted areas are not to be sampled, and there is to be no pre-selection of fish for length, sex, condition, or any other factor.

To ensure that sockeye and chum samples are not missed the crews will begin sampling the first day the respective species catches are delivered from the designated sampling areas each week (Tables 2 and 3).

The standard procedures for collecting and recording salmon ALS data are defined in Appendix A and B. The accuracy of the data will be the responsibility of the crew leaders. If questions or problems arise, do not hesitate to inquire with your supervisor for clarification or assistance.

Periodically inseason the Lazy Bay crew will send their completed (original) opscan forms and scale impression acetates to the Kodiak office for final processing. Correspondence should be directed to Patty Roche. The Lazy Bay crew leader will notify the Kodiak office by radio that the data are being sent, and will maintain a log book of all out-going samples. The original scale cards and copies of the opscan forms should be hand carried to town at the end of the season.

Table 2. Sockeye salmon catch sampling schedule for the Kodiak Management Area, 1991.

Crew	District/Section	SAMPLING AREA		Season	SAMPLE			Fishery
		Geographic Area	Statistical Area		Freq.	Size ^a	Data	
Port of Kodiak	N. W. Kodiak/Central	Uganik/Viekoda Bays	253	June 9-Aug 31	Weekly	600	Scales	Mixed-stock
	Afognak District, ^b							
	Shuyak Is. Section & NW Afognak Section	Point Banks to Raspberry Cape	251-30 thru 70	July 6-25	Weekly ^c	600 ^d	ALS	Mixed-stock
	SW Afognak Section		251-10,20	July 6-25	Weekly ^c	600	ALS	Mixed-stock
	Mainland District ^b							
	Dakavak Section	Dakavak Bay	262-10 through 55	July 6-25	Weekly ^c	600	ALS	Mixed-stock
Lazy Bay	Outer Kukak Bay Section	to Cape Douglas						
	Hallo Bay Section							
	Big River Section							
	N.W. Kodiak/Central	Uyak Bay ^e	254-10,20	June 9-Aug 31	Weekly	600	Scales	Mixed-stock
	Mainland/Cape Igvak	Imuya Bay to Cape Aklek	262-70,80,90,95	June 9-July 25	Weekly	480	ALS	Mixed-stock
	Alitak Bay/Cape Alitak	Cape Alitak	257-10,20	June 9-Aug 31	Weekly	600	Scales	Mixed-stock
	Alitak Bay/Moser Bay	Moser/Olga Bay	257-40,41	June 9-Aug 31	Weekly	600	Scales	Mixed-stock
		Moser/Olga Bay	257-40,41	June 9-Aug 31	Weekly	600	Scales	Terminal
	S.W. Kodiak/Inner, Outer Ayakulik	Red River	256-10,20	June 9-Aug 31	Weekly	600	Scales	Terminal

^a If the required 600-fish sample is impossible to obtain, reduce sample size to 480 fish.

^b The goal is to obtain a 600-fish weekly sample from: (1) NW Afognak and Shuyak Island Sections combined; (2) the SW Afognak Section; and (3) the Dakavak Bay to Cape Douglas reach of the Mainland District. When no pure samples are available from these areas, a combined Mainland and Afognak Districts 1,200-fish sample should be taken.

^c Sample each opening if there is more than one opening per week.

^d Exclude fish caught terminally at Thorshiem from the mixed stock sample. However, estimate the number of fish caught terminally for each opening; if possible obtain a pure terminal sample (600 fish-ALS) aside from the regular mix-stock fishery samples.

^e To be sampled at Larsen Bay and/or Port Bailey.

Table 3. Chum salmon catch sampling schedule for the Kodiak Management Area, 1991.

Crew	SAMPLING AREA		Season ^b	SAMPLE ^a		
	Geographic Area	Statistical Area		FREQ. ^b	SIZE	DATA
Port of Kodiak	Kiliuda Bay	258-20	Aug 1-Aug 21	Weekly	440	Scales
	Zachar Bay ^c	254-30	July 1-July 31	Weekly	440	Scales
Lazy Bay	Sulua/Portage	257-60	Aug 1-Aug 21	Weekly	440	Scales
	Kukak Bay ^c	262-25,27	Aug 1-Aug 31	Weekly	440	Scales

^a Crews will collect scales only, no lengths or sexes.

^b Samples will be collected only on the weeks when the fishery is terminal and directed specifically for chum salmon.

^c The M/V Coho may be able to collect the samples on the fishing grounds.

All scales collected by the Lazy Bay crew will be pressed and aged at Lazy Bay prior to being mailed to Kodiak. An updated copy of the sampling log (Figure 2) should be sent weekly to the Kodiak office.

The Lazy Bay crew leader will maintain a daily log of job-related activities. Additionally the crew leader will prepare a report at the end of the season defining problems that occurred over the season, and solutions and suggestions for the following season.

On a time-permitting basis the Lazy Bay crew will assist the weir crews at Upper Station and Akalura in sampling sockeye escapement. At Upper Station the crew will sample 240 sockeye salmon weekly, while at Akalura the crew will sample 480 fish at the peak of the first escapement and again at the peak of the second escapement.

Each crew leader should review the Kodiak Management Plan contained in Appendix C.

At the end of the season the Lazy Bay crew leader will inventory all gear at the Lazy Bay camp and send to Kodiak that gear which needs repair. The State rifle is the only equipment that must be returned to Kodiak. All other equipment can be locked up on-site.

Figure 2. Lazy Bay catch sampling log, 1991.

[illegible]

APPENDIX A

Scale Sampling Techniques

KODIAK SCALE SAMPLING TECHNIQUE

The following is an explanation of how salmon scale samples are taken. If you have not taken scales before or if you have any questions ask the Kodiak Research Project Leader, Pat Holmes, to demonstrate the sampling procedure. Scales must be readable to be useful, so follow proper techniques when sampling.

Important Points to Remember

Gum Cards

A scale card is a gum-backed sheet numbered 1 through 40. Samples are placed on the cards with no attempt to separate the fish by their sex.

It is important to keep the gum card dry at all times. If weather does not allow you to do this it is best to suspend sampling until dryer conditions prevail. A wet gum card is useless as the scales will shift and come off and prevent a readable impression from being taken.

A new scale card is started for each day. Even if a card is not filled a new card is still to be started for each day. Also, a different card is to be used for each location, i.e. Red River vs. Cape Alitak. It is important that scale cards and numbers match the corresponding AWL sheet.

Scales

1. Clean the scale by wetting it and rubbing it between your fingers. Make sure no dirt, slime or skin (no silver color) remain on the scale.
2. Mount the scale on the gum card with the ridged side up. The ridged side is the same side that is exposed on the salmon.
3. One scale will be taken from sockeye and chum. Two scales will be taken for coho, and three scales for king salmon.
4. Take the preferred scale if it is available, if not available take a scale but note it is not preferred.
5. Scales should be neat, clean, and orderly.

Age-Weight-Length (AWL) Sampling Form

Age - Scale samples are taken for age.

Weight - Taken to nearest tenth of a kilogram on any adult fish not being returned live to the water.

Length - Taken with the fish laying flat from the mid-eye point to the fork of the tail. Measure to the nearest millimeter.

** Fill in all information on the AWL form.

** Each AWL form should match up with the appropriate scale card.

APPENDIX B

Completion of mark sense A.W.L. forms

Length, Sex, and Scale Sampling Procedure for Sampling:
Using Mark-Sense Forms
(Recommended by Statewide Stock Biology Group, May 1985)

INTRODUCTION

Salmon from the catch are sampled for length, sex, and scales annually by field crews throughout the state. This data base is essential to sound management of the State's salmon resources. This information is drawn upon by management and research biologists for: (1) forecasting run strengths; (2) setting escapement goals; (3) examining the productivity of each system; (4) salmon growth analysis; (5) catch apportionment (based on age composition and/or scale pattern analysis); (6) in-season run estimation; and (7) to gain a better understanding of the biology of each stock.

For clarification purposes a SCALE SAMPLE and SUB-SAMPLE will be defined as follows:

SCALE SAMPLE: A data set collected from a specific sampling location, containing scales and data from a single species, collected during a single year. All data forms and scale cards of a single SAMPLE have the same statistical code. AWL and scale card number in a sample are consecutively and chronologically ordered.

SUB-SAMPLE: Any portion of a scale sample consisting of consecutively numbered AWL's and scale cards. SUB-SAMPLES usually consist of one or more time segments of a sample.

To be useful, data must be recorded on the mark-sense forms neatly and accurately. The following procedures are to be adhered to when sampling for length, sex, and scales using mark-sense AWL forms.

COMPLETING THE FORMS:

A completed mark-sense AWL form and accompanying gum card for sampling commercial catches of sockeye and chum salmon are shown in Appendix B.1. A completed AWL form and accompanying gum cards for sampling commercial catches of chinook and coho salmon are shown in Appendix B.2.

Complete each section of the left side of the mark-sense form using a soft No. 2 pencil and darken the corresponding blocks as shown in the figures. Make every effort to darken the entire block as partially filled blocks are often missed by the optical scanner which reads and records the data from the mark-sense AWL forms. Label only one form at a time to avoid "the carbon paper effect" and resulting stray marks.

Description:

For escapement sampling: Species/Area/Catch or Escapement/gear type i.e. weir/Samplers (name and W-R-P)

DO NOT WRITE IN THIS MARGIN

102661

DESCRIPTION

Area: Nelson Lagoon

Samplers: W. Doug McKinnon
P. Joann Mitchell
R. Jim McCullough

Scale readers Tracy McKinnon

ADFLG ADULT SALMON AGE LENGTH
FORM VERSION 2.1

CARD: 083

REEL: 2

DAY catch date: 26

MONTH: 6

YEAR: 87

DISTRICT: 313

SUBDISTRICT: 30

STREAM:

LOCATION: Port Moller

PERIOD: 26

PROJECT: 1

GEAR: 1

MESH:

TYPE OF LENGTH MEASUREMENT: 2

NUMBER SCALES/FISH: 1

OF CARDS: 1

100's	10's	AGE GROUP	AGE LENGTH CODE
75	00	1	1
76	00	1	1
77	00	1	1
78	00	1	1
79	00	1	1
80	00	1	1
81	00	1	1
82	00	1	1
83	00	1	1
84	00	1	1
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31	00	1	1
32	00	1	1
33	00	1	1
34	00	1	1
35	00	1	1
36	00	1	1
37	00	1	1
38	00	1	1
39	00	1	1
40	00	1	1
41	00	1	1

AREA: Moller to Seniavin

Samplers: W - Tracy McKinnon
P - Jordan Mitchell
R - Jim McCullough

Scale readers: McKinnon

ADPBG ADULT SALMON AGE LENGTH FORM VERSION 2.1

DO NOT WRITE IN THIS MARGIN

103328

001
A, B, C,
Chinook
DAY (caught)
20
MONTH
6
YEAR
87
DISTRICT
315
SUBDISTRICT
NITELAN
LOCATION
Port Moller
PERIOD
PROJECT
GEAR
FISH
TYPE OF LENGTH MEASUREMENT
NUMBER SCALES FISH
4
OF CARDS
1

100's
LENGTH
1's
AGE GROUP
AGE ERROR CODE

Card 1 A
Card 1 B
Card 1 C

Fish 01
Fish 02
Fish 03
Fish 04
Fish 05
Fish 06
Fish 07
Fish 08
Fish 09
Fish 10
Fish 11
Fish 12
Fish 13
Fish 14
Fish 15
Fish 16
Fish 17
Fish 18
Fish 19
Fish 20

Appendix B.2. Example of AWL and gum cards for sampling more than one scale per fish.

Species: Chinook Card No: 001A
Locality: Moller to Seniavin Catch
Stat. Code: 315
Sampling Date: Mo 20 Day 6 Year 87
Gear: purse seine
Collector(s): McKinnon, Mitchell, McCullough
Remarks: 3 scales per fish

Species: Chinook Card No 001B
Locality: Moller to Seniavin
Stat. Code: 315
Sampling Date: Mo 20 Day 6 Year 87
Gear: purse seine
Collector(s): McKinnon, Mitchell, McCullough
Remarks: 3 scales per fish

Species: Chinook Card No 001C
Locality: Moller to Seniavin Catch
Stat. Code: 315
Sampling Date: Mo 20 Day 6 Year 87
Gear: purse seine
Collector(s): McKinnon, Mitchell, McCullough
Remarks: 3 scales per fish

Card:

The AWL forms and corresponding gum card(s) are numbered sequentially by date throughout the season starting with 001. A separate numbering sequence will be used for each species, gear type, district, and geographic location. Consult your port supervisor for the current card number. Sockeye and chum samples will have only 1 card per AWL form as shown in Appendix B.1. Coho and chinook samples will contain up to four cards per AWL form as shown in Appendix B.2.

Species:

Refer to the reverse side of the AWL form for the correct digit.

Day, Month, Year:

Use appropriate digits for the date the fish are caught.

District:

List only one district. Consult project leader for appropriate district, subdistrict, and stream numbers.

Subdistrict:

List a single subdistrict if it is known and all the fish sampled were from that single subdistrict. Leave blank if more than one subdistrict is involved or if the subdistrict is unknown.

Stream:

Leave blank for catch sampling; for escapement sampling consult project leader for appropriate number.

Location:

List the appropriate code as shown on Table B.1.

Period:

List the statistical week in which the fish were caught (Table B.2).

Project:

Refer to the reverse side of the AWL form for the correct code.

Gear:

Refer to the reverse side of the AWL form.

Mesh:

Leave blank unless specifically instructed by supervisor to do otherwise.

Type of length measurement:

Use (2) mid-eye to fork-of-tail (unless specifically instructed to do otherwise). Refer to Appendix B.3.

of cards:

Mark 1 when sampling sockeye, chum, coho, and chinook salmon (Appendix B.1). When

Table B.1. Assigned port and weir location codes. (Use under location in filling out AWL's for catch and escapement sampling.)

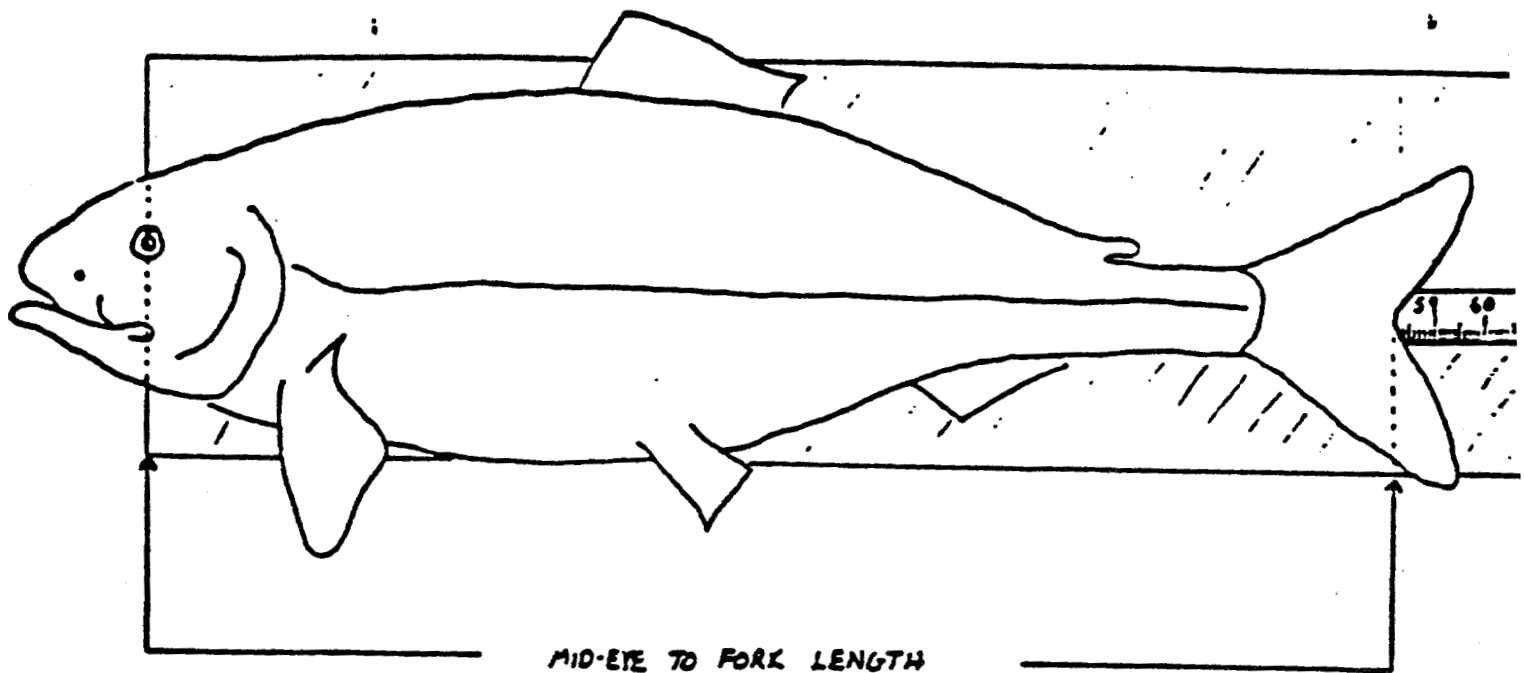
Port Codes

001 - Pelican
 002 - Elfin Cove
 003 - Sitka
 004 - Juneau
 005 - Petersburg
 006 - Ketchikan
 007 - Craig
 008 - Port Alexander
 009 - Metlakatla
 010 - Excursion Inlet
 011 - Hoonah
 012 - Wrangell
 013 - Out of State
 014 - Kake
 015 - Gedney
 016 - Security Bay
 017 - Meyers
 018 - Pt. Baker
 019 - Klawock
 020 - Yakutat
 030 - Lazy Bay
 031 - Port of Kodiak
 032 - Pauls Lake
 033 - Thorshiem
 034 - Afognak River
 035 - Karluk River
 036 - Red River
 037 - Upper Station
 038 - Frazer Lake
 039 - Dog Salmon
 040 - Akalura River
 041 - Uganik River
 150 - King Cove
 151 - Port Moller
 052 - Dutch Harbor
 053 - Akutan
 054 - Sand Point
 055 - Bear River, ADF&G Camp
 056 - Nelson River, ADF&G Camp
 057 - Canoe Bay

Table B.2. Statistical weeks and corresponding calendar dates for 1991.

Statistical Week	Calendar Dates	Statistical Week	Calendar Dates
1	01-Jan to 05-Jan	28	07-Jul to 13-Jul
2	06-Jan to 12-Jan	29	14-Jul to 20-Jul
3	13-Jan to 19-Jan	30	21-Jul to 27-Jul
4	20-Jan to 26-Jan	31	28-Jul to 03-Aug
5	27-Jan to 02-Feb	32	04-Aug to 10-Aug
6	03-Feb to 09-Feb	33	11-Aug to 17-Aug
7	10-Feb to 16-Feb	34	18-Aug to 24-Aug
8	17-Feb to 23-Feb	35	25-Aug to 31-Aug
9	24-Feb to 02-Mar	36	01-Sep to 07-Sep
10	03-Mar to 09-Mar	37	08-Sep to 14-Sep
11	10-Mar to 16-Mar	38	15-Sep to 21-Sep
12	17-Mar to 23-Mar	39	22-Sep to 28-Sep
13	24-Mar to 30-Mar	40	29-Sep to 05-Oct
14	31-Mar to 06-Apr	41	06-Oct to 12-Oct
15	07-Apr to 13-Apr	42	13-Oct to 19-Oct
16	14-Apr to 20-Apr	43	20-Oct to 26-Oct
17	21-Apr to 27-Apr	44	27-Oct to 02-Nov
18	28-Apr to 04-May	45	03-Nov to 09-Nov
19	05-May to 11-May	46	10-Nov to 16-Nov
20	12-May to 18-May	47	17-Nov to 23-Nov
21	19-May to 25-May	48	24-Nov to 30-Dec
22	26-May to 01-Jun	49	01-Dec to 07-Dec
23	02-Jun to 08-Jun	50	08-Dec to 14-Dec
24	09-Jun to 15-Jun	51	15-Dec to 21-Dec
25	16-Jun to 22-Jun	52	22-Dec to 28-Dec
26	23-Jun to 29-Jun	53	29-Dec to 31-Dec
27	30-Jun to 06-Jul		

Appendix B.3. Measuring fish length.



Because the length and form of the snout of salmon changes as the fish approaches sexual maturity, length measurements are made from the middle of the eye to the fork of the tail. The length is always recorded to the nearest millimeter. The procedure for measuring length (mid-eye to fork) of the salmon is as follows:

1. Place the salmon flat on the board with the head to your left and the dorsal fin away from you.
2. Make sure your eye is directly over the end of the board. Line the eye of the salmon up with the edge of the board and hold the head in place with your left hand. It helps to place a finger in the salmon's eye for reference.
3. Flatten and spread the tail against the board with your right hand.
4. Read the mid-eye to fork length to the nearest millimeter.

sampling chinook and coho salmon write the card numbers (i.e. 001A, 001B, 003B, etc.) perpendicular to the left of the fish # column as shown in Appendix B.2.

It is paramount to keep the mark-sense forms flat, dry, and clean. Fish gurry and water curling will cause data to be misinterpreted by the optical scanning machine. In general, keep the forms neat enough and legible enough to have a stranger be able to make sense out of them.

Additional data columns are available on the reverse of the AWL for individual project use. If you as a project leader use them and wish that data to be read by the opscan reader, you will need to transfer the litho code from the front of the form to the reverse.

GUM CARD(S):

Fill out the gum cards as shown in Appendices B.1 and B.2.

Species:

Write out completely (i.e., chinook, sockeye, etc.).

Locality:

For catch sampling and escapement sampling write down area in which fish were caught followed by the word catch or escapement (i.e. Karluk River escapement).

Stat. code and Sampling date:

Transfer the appropriate digits from the AWL form.

Gear:

Write out completely.

Collector(s):

Record the last name or initials of the person(s) sampling.

Remarks:

Record any pertinent information such as number of scales per fish sampled, vessel/tender name, etc. Transfer this same information to the top margin of the AWL.

SAMPLING:

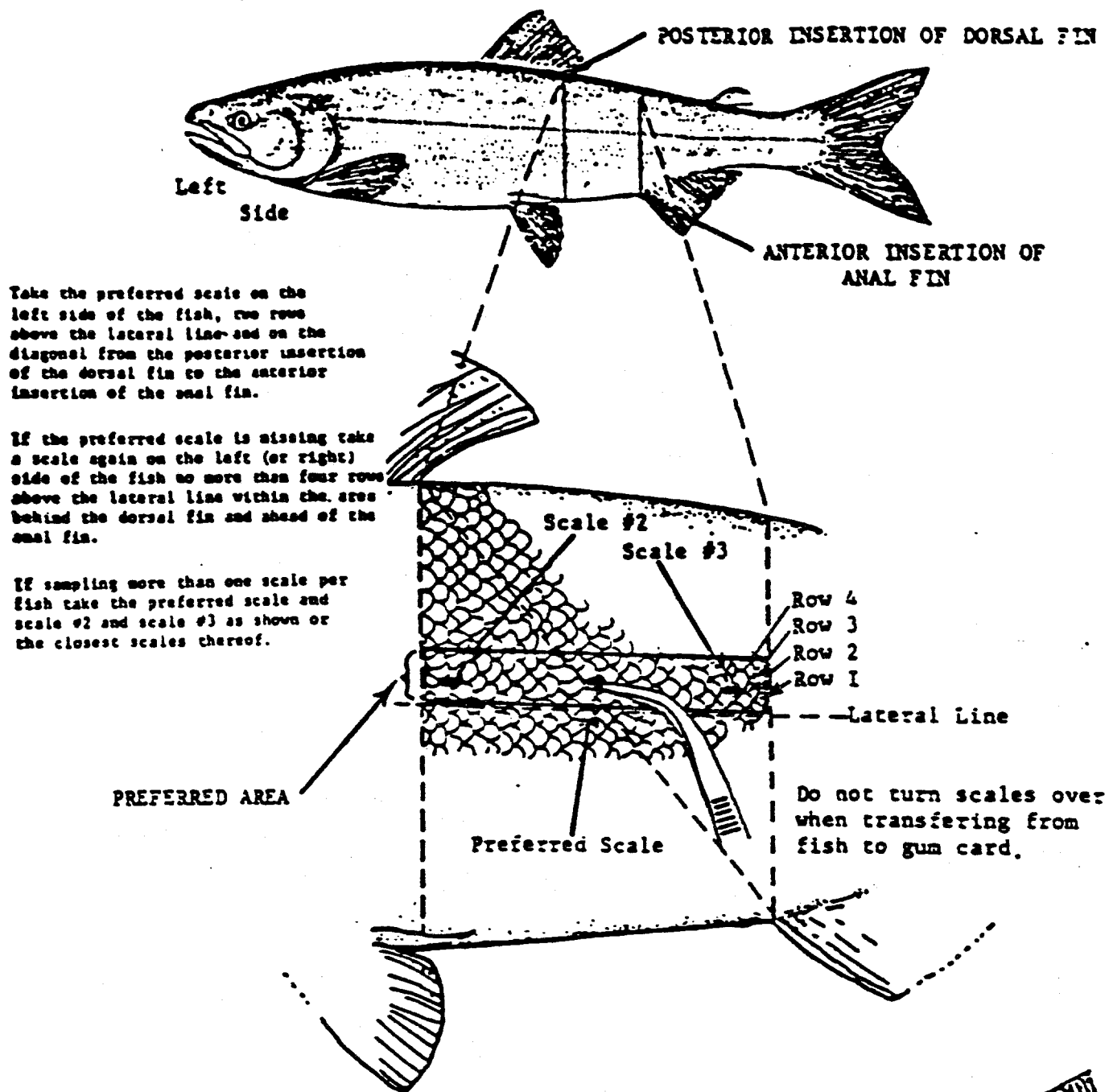
A. GENERAL

1. Sex the fish and darken M or F in the sex columns. If any difficulty was encountered in this procedure, write "I had trouble sexing these fish" on the top margin of the AWL and ask your supervisor for help as soon as possible before sexing additional fish.
2. Measure all species' length in millimeters from the middle of the eye to the fork of the tail, refer to Appendix B.3. Record length by blackening the appropriate column blocks on the AWL form. Column 3 on the AWL form is used for fish over 999 millimeters

long (Big Daddy Chinook). Measure all species of salmon to the nearest mm. Check the calipers daily, before use, to ensure the accuracy of the measurements.

3. Pluck the "preferred scale" from the fish using forceps. Remove all slime, grit, and skin from the scale by moistening and rubbing between fingers. The "preferred scale" is located on the left side of the fish, two rows above the lateral line on the diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin, refer to Appendix B.4. If the "preferred scale" is missing, select a scale within the preferred area on either the left or right side of the fish. If no scales are present in the "preferred area" on both sides of the fish, sample a scale as close to the preferred area as possible and darken the 8 under "age error code" on the AWL form.
4. Clean, moisten and mount scale on gum card directly over number 1 as shown in Appendix B.4. The side of the scale facing up on the gum card is the same as the side facing up when it was adhered to the fish. This outward facing side is referred to as the "sculptured" side of the scale. The ridges on this sculpture side can be felt with a fingernail or forceps. Mount scale with anterior end oriented toward top of gum card.
5. When sampling sockeye and chum salmon repeat steps 1 through 4 for up to 40 fish on each AWL form.
6. When taking multiple scales per fish as with chinook and coho salmon sample the "preferred scale" and scale #2 as shown in Appendix B.4. Scale #2 is one inch to the left of the "preferred scale," and is 2 rows above the lateral line. Mount the 2 scales from fish #1 over 1 and 11 on the gum card as shown in Appendix B.2. Continuing, mount the 2 scales from fish #2 over 2 and 12, etc. If sampling 3 scales, mount the scales over #1, #11, #21, etc.
7. Use plastic scale card holders to hold individual scale cards during sampling and cover the completed gum card with wax paper for storage.
8. When sampling a weired system you may use write in rain books to record the data. Keep the mark-sense forms in camp where they will be clean, dry, and flat. After sampling is done for the day transfer the data to the mark-sense forms. It is the responsibility of the data collector to transcribe the data before turning it over to the ARB.
9. Miscellaneous:
 - a. When scales are sampled in wet conditions it is difficult to mount scales in a fashion so as to result in a good scale impression being made. Glue often obscures scale features and scales frequently adhere poorly to the card. In this situation the scales should be remounted.
 - b. For adipose clipped fish record the head tag number on the corresponding row in the first five columns on the reverse side of the AWL.

Appendix B.4. Scale sampling procedure showing the preferred scale sampling area on an adult salmon.



NOTE: Mount scales with anterior portion of scale oriented toward top of card.

Place scales directly over number on gum card.

10	9	8	7	6	5	4	3	2
20	19	18	17	16	15	14	13	12
30	29	28	27	26	25	24	23	22
40	39	38	37	36	35	34	33	32

- c. Look down the form from two angles after the data has been recorded to pick up any glaring mistakes. A common error occurs, for instance, in placing both the 4 and 7 of a 475 mm fish in the 100's column with nothing in the 10's column.
 - d. Keep all fish gurry off forms and erase any stray marks on the forms before turning them in to your supervisor.
 - e. Write in all comments explicitly and completely under remarks, transfer remarks to top margin of AWL.
 - f. Responsibility for accuracy lies first with the primary data collector(s). The port supervisor will return sloppy or incomplete data to individual collectors. After editing a form, place your initials next to card #, but not in left margin.
10. As soon as possible after completion send the samples and mark-sense forms to the ARB in Kodiak. During scheduled radio calls before and following the sending of data to the ARB, the crew leader will notify the ARB: 1) that the data is being mailed (use a moisture-proof container); 2) what data is being sent; 3) when delivery is expected in Kodiak; and 4) who is transporting the data. It is important that these steps are followed to ensure delivery.

B. SAMPLING SCENARIOS:

1. Differing size crews:

- a. One person: Wrestle the fish into the measuring board, wearing a glove on one hand. Measure the fish and write the sex and length down on the measuring board to be transferred to the AWL after ten fish have been measured. Next, pluck the preferred scale(s), clean, and mount on the gum card which is taped to the AWL in the clipboard which is sitting on the end of the measuring board. After ten fish have been processed, remove the glove and record the sexes and lengths on the AWL with your clean hand. A slime rag may be helpful.
- b. Two persons:
 - (1) When sampling more than one scale per fish, one person can wrestle the fish and record data while the other plucks and mounts scales. The wrestler needs to wear a glove that he can slip off his writing hand to record the sex and length data on the AWL form.
 - (2) When sampling one scale per fish, the person plucking the scales also records the data.
- c. Three persons: One person wrestles the fish, one plucks and mounts the scales, and the third records the data.

2. Sampling tote to tote:

- a. When sampling for 2 or 3 scales per fish (chinook and coho) use two persons.
- b. When sampling for 1 scale per fish (sockeye and chum) use three persons, if available.

SCALE SAMPLING CHECKLIST

Clipboard	Pencils (No.2)	Gloves
Gum Cards	Forceps	Measuring board or calipers
AWL's	Wax paper inserts	Sampling Manual
	Plastic scale card holders	

Some Reminders

1. For greater efficiency in scale reading and digitizing, mount scales with anterior end toward top of scale card.
2. AWLs should be carefully edited. Re-check header information on AWLs; make sure all available information is filled in. Take extra care to use the correct statistical week for the sampling or catch date. Page numbers should not be repeated; a frequent error is to begin a week's sample with the last page number used the week before. This is particularly important if the data is regularly sent to town; it is easy to forget which numbers were used. Crew leaders should take time to ensure that the boxes are being blackened correctly, if the boxes are sloppily marked the optical scanner records the information incorrectly or misses it entirely. Keep marks within each rectangle and completely fill them. After AWLs are edited, place editor's initial next to page number, but not in left margin.
3. Check to make sure error codes are being used correctly, i.e. error code 7 is wrong species, error code 8 is non-preferred. Error code 6 is for the use of the scale reader, it refers to the reabsorption of the scale.
4. Transfer important comments from scale cards to AWLs. After pressing scales, the cards are seldom referred to again, and important remarks can be lost. Write comments in the top margin (not on the left side) or on the reverse of the AWL. If there is not room on the AWL to completely explain the remarks, use a separate piece of paper.
5. Never put data from different dates on one AWL or one scale card. Even if only one scale is collected that day, begin a new card and AWL for the next day.
6. If weights are taken, they may be noted in the right margin of the AWL during sampling, but be sure to transfer the weights to the appropriate columns on the reverse of the AWL before submitting it to the ARB.
7. The data processing program uses the "litho code" on the AWL. (It is located in the lower left margin of the AWL.) It helps if the AWLs are used in the order of this code. It should not be hard to keep them in order if they are arranged that way before page numbering. Those who sample different areas throughout the season can arrange the litho codes in order before each sample is taken.
8. If AWLs get wrinkled or splotched they should be copied over before sending in. The optical scanning computer will misread or reject wrinkled sheets.

APPENDIX C

Kodiak Management Plan

*** NOT COMPLETED ***

1991 OPERATIONAL PLAN

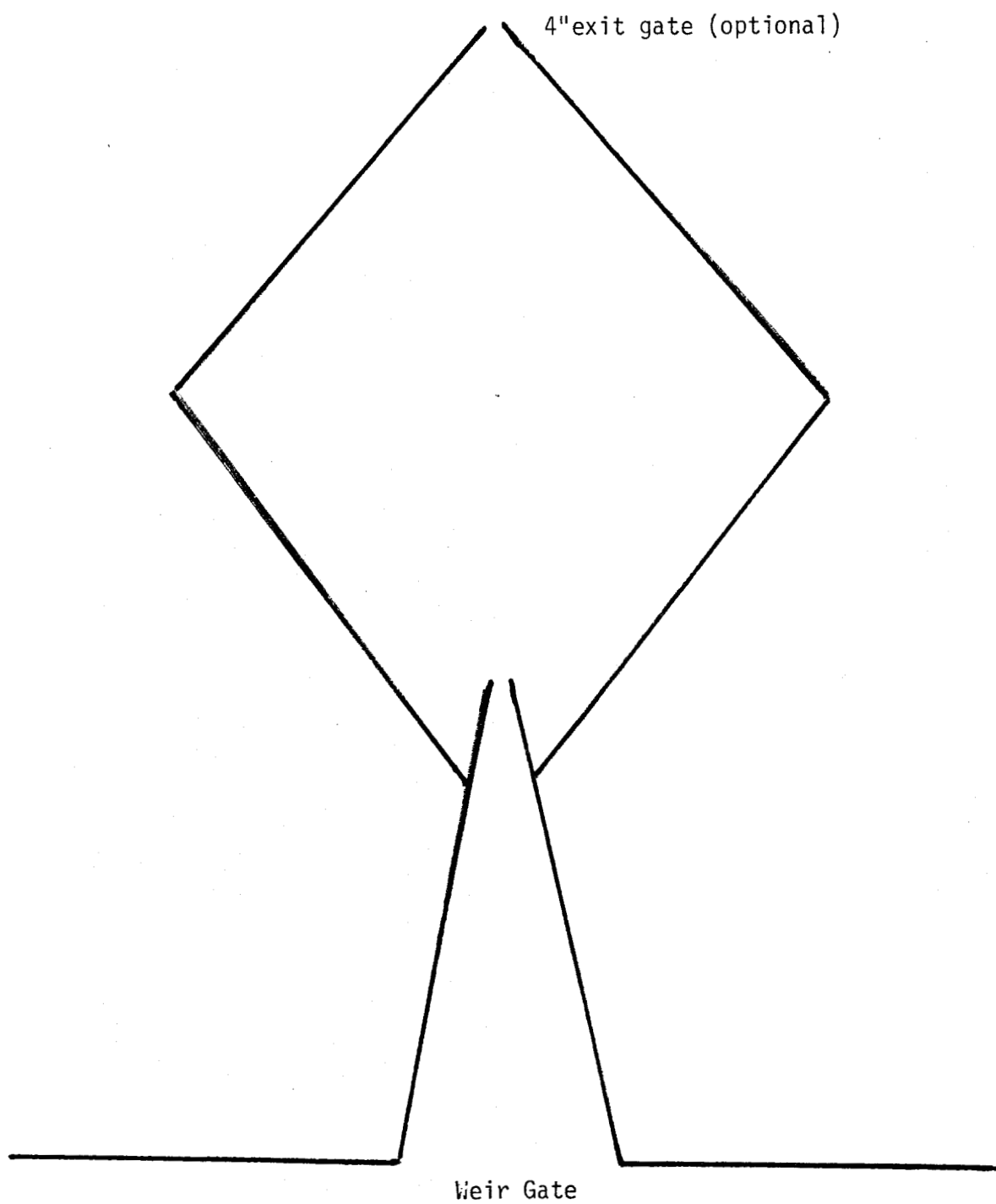
KODIAK MANAGEMENT AREA

SOCKEYE AND COHO SALMON ESCAPEMENT SAMPLING

(Length, Sex, and Scale Sampling Procedure for Sampling
Using Mark-Sense Forms)

Alaska Department of Fish and Game
Division of Commercial Fisheries
211 Mission Road
Kodiak, Alaska 99615

Figure 1. The "Scott" six panel salmon trap.



OBJECTIVES

1. Determine age, length at age, and sex composition of selected sockeye escapements within the Kodiak Management Area. Similarly collect data for coho salmon escapements.
2. Results will be published in a Regional Information Report by C. Swanton.

SUPERVISION

Kodiak Area management staff Pat Holmes, Kevin Brennan, and Dave Prokopowich will oversee escapement sampling at all weir projects except Frazer and Akalura. Pat Holmes will monitor weekly escapement sampling and review incoming data for completeness, and scale mounting technique. Patricia Roche will fill Pat's role during absences. Weir crew leader's and the Area Biologist will be notified regarding data quality.

A log book will be maintained concerning the quality of sampling and compliance with the sampling schedule. This documentation will be included in individual personnel evaluations.

PROCEDURES

Weekly, weired sockeye systems (Uganik, Karluk, Upper Station, Ayakulik) will be sampled for age, length and sex (ALS) (Figure. 2, Table 1). A total of 240 fish per week will be collected on the 5th day (Thursday). If the required number of fish are not taken within a single day, obtain the balance of the sample on the following day (Friday). Notify the office if sampling difficulties occur that require changing this schedule; these changes should be noted in your log book and on the sampling data sheets. The crew leader will notify Dave Prokopowich or Kevin Brennan via SSB radio upon completion of weekly sampling. Completed ALS data from Karluk weir will be mailed to Kodiak (return receipt from the post office) and the office notified of mailing date.

Afognak weir personnel will collect 600 samples from both early and late sockeye run components. A single 600 fish sample will be collected at the Saltery weir during the peak escapement. Personnel will notify Pat Holmes if assistance with sampling is necessary.

Minor systems will also have escapement samples collected but with reduced intensity. The Pauls Lake staff will collect three 240 fish samples during the peak escapement period. If sampling at the weir is unfeasible, a 600 fish sample will be collected using a beach seine at the stream mouth or lake. A single 240 fish sample

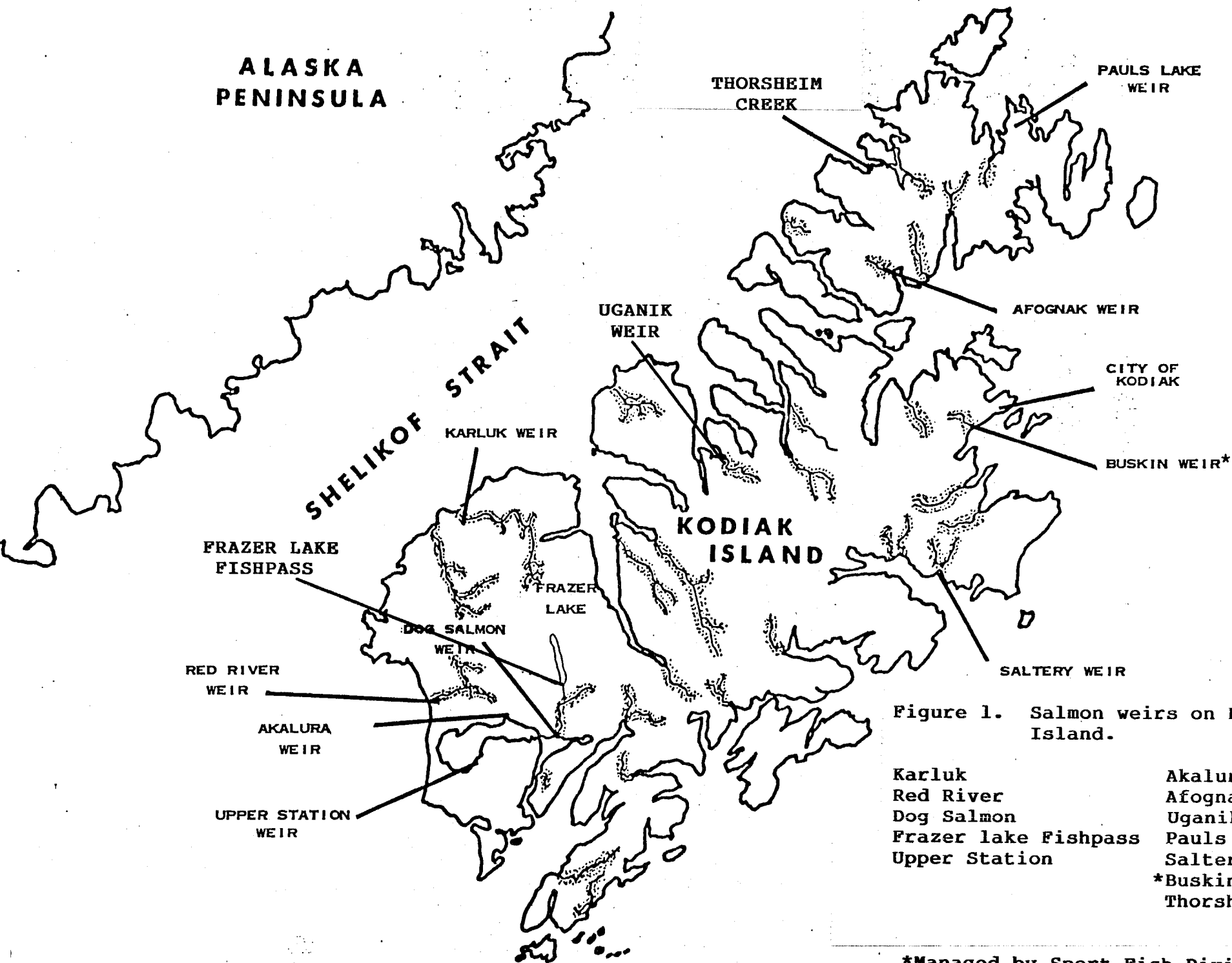


Figure 1. Salmon weirs on Kodiak Island.

- | | |
|----------------------|---------------|
| Karluk | Akalura Lake |
| Red River | Afognak River |
| Dog Salmon | Uganik River |
| Frazer lake Fishpass | Pauls Lake |
| Upper Station | Saltery River |
| | *Buskin River |
| | Thorsheim |

will be obtained by Sport Fisheries Division (S.F.D.) personnel for Buskin Lake at the escapement peak (sample size specified by S.F.D. biometrician). Pat Holmes will be responsible for collecting 600 fish samples from Little River, Malina, and Kafkia Lakes at or near peak escapement. David Kaplan and Chris Hicks will be responsible for collecting a 600 fish sample from Thorshiem (either from the escapement or terminal seine catch).

Coho escapement samples will be collected at Karluk, Ayakulik, Upper Station, Saltery, and Uganik River weirs. A total of 280 coho will be sampled (two scales per fish) at each location within a 10 day period during peak escapement. Pat Holmes will provide assistance at Saltery weir if requested. Sport Fisheries Division staff will sample 150 fish at or near peak escapement for the Buskin River (sample size specified by S.F.D biometrician).

It is essential that all ALS data be representative of the true escapement, therefore avoid bias by: NOT pre-selecting fish based upon size, sex, condition or any other factor. Data collection and recording procedures are presented in Appendices A and B. Sampling schedules defined by statistical week (Table 2) for 1991 are given in Table 1.

The following appendices provide an explanation of how samples should be collected. If you have not collected scales before, or if you have any questions ask Pat Holmes or Charlie Swanton to demonstrate the procedure. Scales must be readable and data must be recorded accurately to be useful.

SAMPLING SCENARIOS:

1. Differing size crews:

- a. One person:

Wrestle the fish into the measuring board, wearing a glove on one hand. Measure and sex the fish. Remove a glove, pluck the preferred scale with the clean hand, release the fish, clean and mount the scale on the gum card in the card holder (which is kept in a protected place). Record the sex and length on "rite-in-the-rain" book or tape recorder (transfer the data to the AWL after sampling). A slime rag may be helpful.

- b. Two persons:

One person can wrestle the fish while the other records the data, plucks and mounts scales.

- c. Three persons:

One person wrestles the fish, one plucks and mounts the scales, and the third records the data.

Table 1. Sockeye salmon escapement sampling schedule, 1991.

Location	Sampling Frequency	<u>Date</u>		Sample Size
		Starting	Ending	
Karluk weir	weekly	June 2	Sept 30	240
Red River	weekly	June 2	Sept 30	240
Upper Station	weekly	June 2	Sept 30	240
Afognak weir (early)	once	June 9	June 15	600
Afognak weir (late)	once	July 14	July 20	600
Little River Lake	once	June 9	June 15	600
Uganik Lake weir ^a	weekly	June 2	Oct.5	240
Saltery River weir	once	July 7	July 20	600
Buskin Lake weir ^b	once	June 30	July 13	240
Pauls Lake weir	weekly	June 9	June 29	240
Kaflia Lake	once	July 7	July 20	600
Malina Lake	once	July 7	July 27	600
Thorshiem Creek ^c	once	June 30	July 13	600

^a Sampled by USFWS.

^b Sampled by Sport Fisheries Division? (Sample size determined by S.F.D. Biometrician)

^c Sample may be obtained from the terminal catch.

Table 2. Statistical weeks and corresponding calendar dates for 1991.

Statistical Week	Calendar Dates	Statistical Week	Calendar Dates
1	01-Jan to 05-Jan	28	07-Jul to 13-Jul
2	06-Jan to 12-Jan	29	14-Jul to 20-Jul
3	13-Jan to 19-Jan	30	21-Jul to 27-Jul
4	20-Jan to 26-Jan	31	28-Jul to 03-Aug
5	27-Jan to 02-Feb	32	04-Aug to 10-Aug
6	03-Feb to 09-Feb	33	11-Aug to 17-Aug
7	10-Feb to 16-Feb	34	18-Aug to 24-Aug
8	17-Feb to 23-Feb	35	25-Aug to 31-Aug
9	24-Feb to 02-Mar	36	01-Sep to 07-Sep
10	03-Mar to 09-Mar	37	08-Sep to 14-Sep
11	10-Mar to 16-Mar	38	15-Sep to 21-Sep
12	17-Mar to 23-Mar	39	22-Sep to 28-Sep
13	24-Mar to 30-Mar	40	29-Sep to 05-Oct
14	31-Mar to 06-Apr	41	06-Oct to 12-Oct
15	07-Apr to 13-Apr	42	13-Oct to 19-Oct
16	14-Apr to 20-Apr	43	20-Oct to 26-Oct
17	21-Apr to 27-Apr	44	27-Oct to 02-Nov
18	28-Apr to 04-May	45	03-Nov to 09-Nov
19	05-May to 11-May	46	10-Nov to 16-Nov
20	12-May to 18-May	47	17-Nov to 23-Nov
21	19-May to 25-May	48	24-Nov to 30-Dec
22	26-May to 01-Jun	49	01-Dec to 07-Dec
23	02-Jun to 08-Jun	50	08-Dec to 14-Dec
24	09-Jun to 15-Jun	51	15-Dec to 21-Dec
25	16-Jun to 22-Jun	52	22-Dec to 28-Dec
26	23-Jun to 29-Jun	53	29-Dec to 31-Dec
27	30-Jun to 06-Jul		

APPENDIX A
SCALE SAMPLING TECHNIQUES

SCALE SAMPLING:

Scale cards:

The scale card is a gum-backed sheet numbered 1 through forty. Scales from the sample are placed on the card with no attempt to separate the fish by sex.

Use the card holders provided to prevent the cards from getting wet during sampling. The cards must be kept dry at all times. A wet gum card may make the scales unreadable. If the weather is too bad, suspend sampling until dryer conditions prevail. When the card gets wet glue often obscures scale features and scales frequently adhere poorly to the card. In this situation the scales should be remounted on a new card. Cover the completed gum card with wax paper for storage, place the cards between two flat surfaces to prevent distortion.

A new, consecutively numbered, card is used each day, even if the previous card is not completed. Scale cards numbers must match the corresponding AWL sheet. Do not repeat the sample number during the season.

Fill out the gum cards as shown in Appendices B.1 and B.2.

Species:

Write out completely (i.e., sockeye, coho).

Locality:

For catch sampling and escapement sampling write down area in which fish were caught followed by "escapement" (i.e. Karluk River escapement).

Stat. Area and Sampling Date:

Transfer the appropriate numbers from the AWL form.

Gear:

Write out completely (weir/trap, beach seine).

Collectors:

Record the last name or initials of the person(s) sampling.

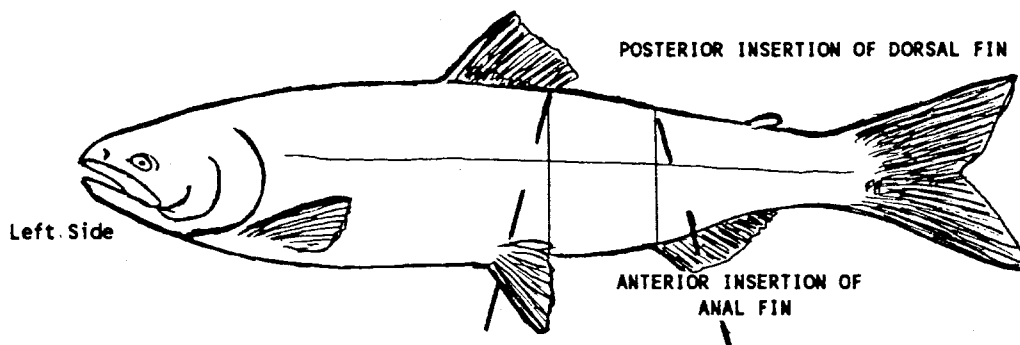
Remarks:

Record any pertinent information such as number of scales per fish sampled, factors affecting sampling, bears in the trap, difficulties sexing fish, ect. Transfer this same information to the top margin of the AWL.

Sampling:

1. Take the preferred scale if it is available, if not note that the scale taken is not preferred (error codes on AWL). The "preferred scale" is located on the left side of the fish, two rows above the lateral line on the diagonal from the posterior

Appendix A.1. Sampling procedure for the preferred scale.



Take the preferred scale on the left side of the fish, two rows above the lateral line and on the diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin.

If the preferred scale is missing take a scale again from the left (or) right side of the fish no more than four rows above the lateral line, within the preferred area, behind the dorsal fin and ahead of the anal fin.

If sampling more than one scale take the preferred scale and scale #2 and scale #3 as shown or the closest scale to that location.

PREFERRED AREA

PREFERRED SCALE

Place the scales directly over the number on the gum card.

Note: Mount scales with the anterior portion (arches) of the scale pointed toward the top of the card.



10	9	8	7	6	5	4	3	2	1
20	19	18	17	16	15	14	13	12	11
30	29	28	27	26	25	24	23	22	21
40	39	38	37	36	35	34	33	32	31

insertion of the dorsal fin to the anterior insertion of the anal fin (Appendix A.1). If the "preferred scale" is missing, select a scale within the preferred area on either the left or right side of the fish. If no scales are present in the "preferred area" on both sides of the fish, sample a scale as close to the preferred area as possible and darken the 8 under age error code on the AWL form. Do not take a scale from the lateral line they are creased and worthless for digitizing!

2. Clean the scale by wetting it and rubbing it between your fingers. Make sure no dirt, slime or skin (no silver color) remain on the scale.
3. Mount the scale on the gum card with the ridged (rough) side up. The ridged (rough) side of the scale is the same side that is exposed on the salmon.
4. Mount scale with the annular ring arches up (Appendix A.1).
5. One scale will be taken from sockeye and two scales from coho (Appendix B.1, B.2). When taking multiple scales per fish sample the "preferred scale" and second scale one inch to the left of the "preferred scale," and two rows above the lateral line. Mount the 2 scales from fish #1 over 1 and 11 on the gum card as shown in Appendix B.2. Continuing, mount the 2 scales from fish #2 over 2 and 12, etc. If sampling 3 scales, mount the scales over #1, #11, #21, etc.
6. Scales should be neat, clean, and orderly.
7. CHECK EACH SCALE FOR CORRECT MOUNTING BEFORE SENDING IT TO TOWN. A light touch with your fingernail and a visual inspection of the orientation of the arches will reveal any problems. Remount the scales if necessary.

SCALE SAMPLING CHECKLIST

Clipboard	Pencils (No.2)	Measuring board or caliper
Gum Cards	Forceps	Sampling Manual
AWL's	Wax paper inserts	Plastic scale card holders
Gloves		

APPENDIX B

COMPLETING THE AGE-WEIGHT-LENGTH (AWL) FORMS:

AGE-WEIGHT-LENGTH (AWL) FORMS

Data must be recorded on the mark-sense forms neatly and accurately. Keep the mark-sense forms flat, dry, and clean. Fish gurry and water curling will cause data to be misinterpreted by the optical scanning machine. The forms should be neat and legible enough to have a stranger be able to make sense out of them.

When sampling a weired system you may use "write-in-rain" books to record the data. Keep the mark-sense forms in camp where they will be clean, dry, and flat. After sampling is done for the day transfer the data to the mark-sense forms. It is the responsibility of the data collector to transcribe the data before sending the forms to the office.

A completed mark-sense AWL form and accompanying gum card for sampling sockeye is shown in Appendix B.1. A completed AWL form and accompanying gum cards for sampling coho salmon are shown in Appendix B.2.

Complete each section of the left side of the mark-sense form using a soft No. 2 pencil and darken the corresponding blocks as shown in the figures. Make every effort to darken the entire block, do not allow your marks to overlap the adjacent rows. Partially filled blocks are often missed by the optical scanner, overlapping marks on adjacent rows creates multiple numbers and error codes for the sampled fish. This causes a lot of problems for Patty Roche and Kim Phillips when they are processing the sample. Do not mark on the left hand margin of the form. Label only one form at a time to avoid "the carbon paper effect" and resulting stray marks. Do not attach any thing to the AWL with paper clips, this may cause the Opscan reader to miss-feed the form.

Description:

Species/Area/Escapement i.e. Sockeye/Karluk weir/Escapement

Samplers: W-(Wrestler) Name

P-(Scale plucker) Name

R-(Recorder) Name

List any factors relating to sampling, number of scales collected, bear in the trap, difficulties sexing fish, ect.

Card:

The AWL forms and corresponding gum card(s) are numbered sequentially by date throughout the season starting with 001. A separate numbering sequence will be used for each species and geographic location. Consult your crew leader for the current card number. The number of cards varies by species; sockeye samples use one card per AWL form (Appendix B.1), coho samples require two cards per AWL (Appendix B.2).

Species:

Refer to the reverse side of the AWL form for the correct number.

Day, Month, Year:

Use the date when the fish are caught.

District, subdistrict, stream number:

List only one district, subdistrict and stream number. I.e. for the Karluk weir: 255(district), 10(subdistrict), 101(stream number) Consult the Kodiak Area Statistical Area Chart for the appropriate district, subdistrict, and stream numbers. If you do not have the chart ask the Kodiak office for the correct numbers, do not leave these sectors blank.

Location:

List the appropriate code as shown on Appendix B.3. For example Karluk weir is (035).

Period:

List the statistical week in which the fish were caught (Table 2).

Project:

Refer to the reverse side of the AWL form for the correct code for escapement sampling (3).

Gear:

Refer to the reverse side of the AWL form for the correct code (19).

Mesh:

Leave blank unless specifically instructed by supervisor to do otherwise.

Type of length Measurement:

Use (2) mid-eye to fork-of-tail, unless specifically instructed to do otherwise (Appendix B.4).

of cards:

Mark 1 when sampling sockeye and coho salmon (Appendix B.1,B.2). When sampling coho salmon write the card numbers (i.e. 001A, 001B,) as shown in Appendix B.2.

Sex:

Darken M or F in the sex columns. If any difficulty was encountered in this procedure, write "trouble sexing fish" on the top margin of the AWL and ask your supervisor for help as soon as possible before sexing additional fish.

Length:

Measure all length in millimeters from the middle of the eye to the fork of the tail, refer to Appendix B.4. Record length by blackening the appropriate column blocks on the AWL form. Column 3 on the AWL form is used for fish over 999 millimeters long. Measure all fish to the nearest mm. If you use calipers check them daily, before use, to ensure the accuracy of the measurements.

Additional data columns:

Additional data may be recorded on the back of the AWL for individual project use. If you use them and wish that data to be read by the opscan reader, you will need to transfer the litho code from the front of the form to the back. Weights, if taken, should be noted in the right hand margin of the awl when during sampling and be transferred to the back of the awl sheet. Adipose clipped fish should have the head tag number recorded on the corresponding row in the first five columns on the reverse side of the AWL. Tagged fish that are sampled should also be recorded in this manner. Note all tagged fish observed in your log book.

After editing a form, place your initials next to card #, but not in left margin.

As soon as possible after completion send the samples and mark-sense forms to the office in Kodiak. During scheduled radio calls before sending the data in, the crew leader will notify the area biologist: 1) that the data is being mailed (use a moisture-proof container); 2) what data is being sent; 3) when delivery is expected in Kodiak; and 4) who is transporting the data. It is important that these steps are followed to ensure delivery.

Reminders

- 1) AWLs should be carefully edited. Re-check header information on AWLs; make sure all available information is filled in. Take extra care to use the correct statistical week for the sampling or catch date. Page numbers should not be repeated; a frequent error is to begin a week's sample with the last page number used the week before. Take time to ensure that the boxes are being blackened correctly. Keep marks within each rectangle and completely fill them. After AWLs are edited, place editor's initial next to page number, but not in left margin. Before sending data forms in, look down the form from two angles to pick up any glaring mistakes.
- 2) Mount the scales correctly, with anterior end (arches up) toward top of scale card with the ridged (rough) side out.
- 3) Make sure the error codes are correct. Error code 7 is wrong species, error code 8 is non-preferred scale. Error code 6 is for the use of the scale reader, it refers to the reabsorption of the scale.
- 4) Transfer important comments from scale cards to AWLs. Important remarks can be lost; after pressing scales, the cards are seldom referred to again. Write comments in the top margin (not on the left side). If there is not room on the AWL to completely explain the remarks, use a separate piece of paper.
5. Never put data from different dates on one AWL or one scale card. Even if only one scale is collected that day, begin a new card and AWL for the next day.
6. If weights are taken be sure to transfer the weights and litho codes to the appropriate columns on the reverse of the AWL before submitting it to the office.
7. If possible Keep the litho code in order. The data processing program uses the "litho code" to track the data files. (It is located in the lower left margin of the AWL.) Keep them in order before numbering the pages.
8. Recopy all wrinkled or splotched AWLs before sending them in. The optical scanning computer will misread, reject, or destroy damaged sheets.

The responsibility for accuracy lies first with the primary data collector(s). Sloppy or incomplete data will be returned to individual collectors. Compliance with the sampling procedures and schedule will be noted in each samplers evaluation.

Appendix B.1 AWL and scale cards for sampling 1 scale per fish.

Samplers Wn-TedStack

Scale reader: P. Roche

DESCRIPTION: Sockeye/Karluk/Escape ment

P - Steve Brown

R - Jeff Fox

ADF&G ADULT SALMON AGE-LENGTH
FORM VERSION 2.1

CARD: 001

SPECIES: Sockeye

DAY: 3

MONTH: June

YEAR: 91

DISTRICT: 255

SUBDISTRICT: 10

STREAM: 101

LOCATION: 35

PERIOD: 23

PROJECT: ESC.

GEAR: weir trap

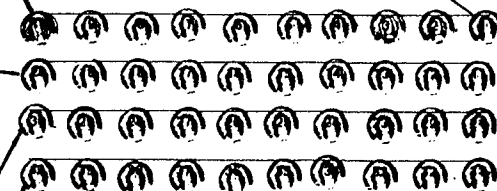
MESH:

TYPE OF LENGTH MEASUREMENT: 2

NUMBER SCALES/FISH: 1

OF CARDS: 1

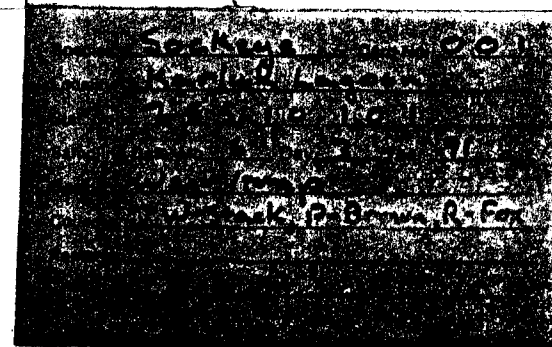
#	SEX	100's	LENGTH	1's	AGE GROUP	AGE ERROR CODE
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
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38						
39						
40						



DO NOT WRITE IN THIS MARGIN

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NCS DOCUSCAN MB20-17877-109 A5200



Appendix B.2 AWL and scale cards for sampling 2 scales per fish.

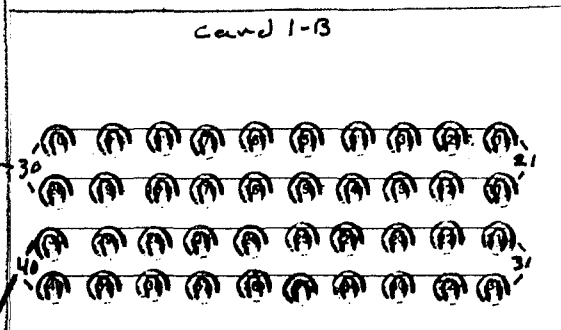
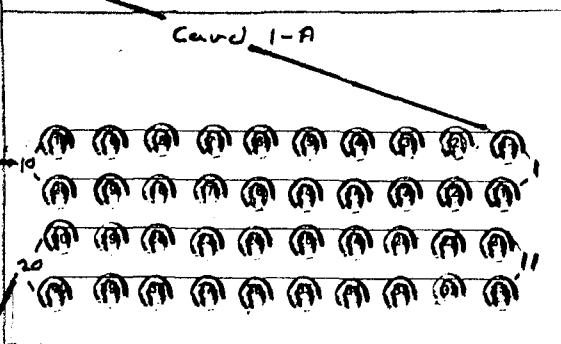
Samplers: W - T. Stack
P - S. Brown
R - J. Fox

Scale Reader: P. Roche

DESCRIPTION: Coho/Karluk/Escapement

ADFG ADULT SALMON AGE-LENGTH
FORM VERSION 2.1

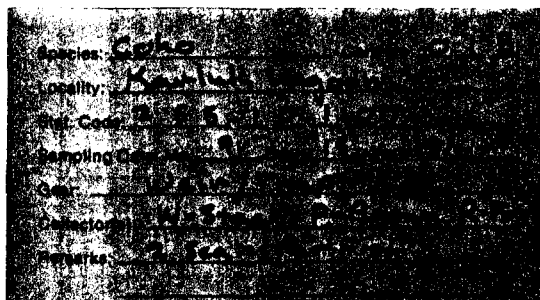
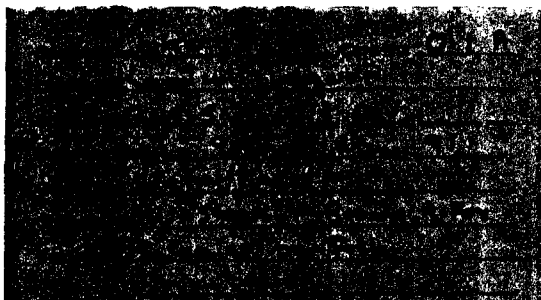
CARD:	001 A, B	SEX	100's	LENGTH	1's	AGE GROUP	AGE ERROR CODE
SPECIES:	Coho						
DAY:	15						
MONTH:	Sept						
YEAR:	91						
DISTRICT:	255						
SUBDISTRICT:	10						
STREAM:	101						
LOCATION:	35						
PERIOD:	38						
PROJECT:	Esc						
GEAR:	Weir/imp						
MESH:							
TYPE OF LENGTH MEASUREMENT	2						
NUMBER SCALES/FISH	2						
# OF CARDS							



DO NOT WRITE IN THIS MARGIN

219722

NCS DOCUSCAN® MB20-17877-109 A5200

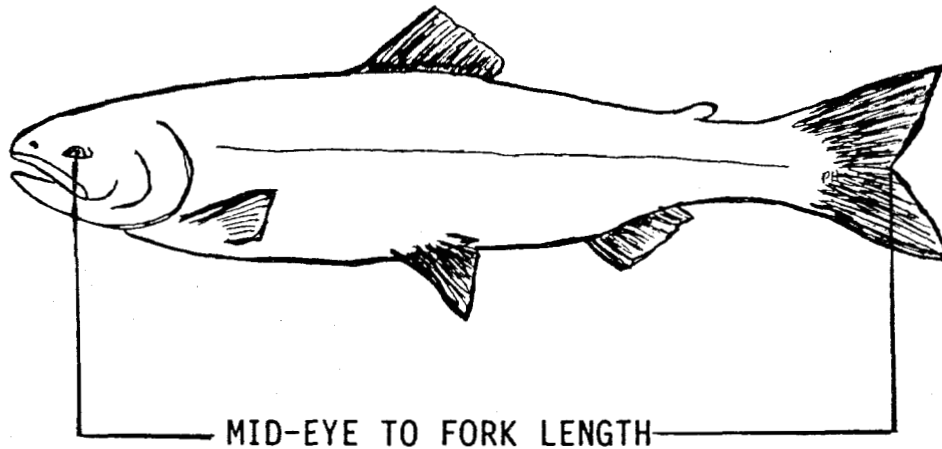


Appendix B.3. Assigned port and weir location codes.

Port Codes

030 - Lazy Bay
031 - Port of Kodiak
032 - Pauls Lake
033 - Thorshiem
034 - Afognak River
035 - Karluk River
036 - Red River
037 - Upper Station
038 - Frazer Lake
039 - Dog Salmon
040 - Akalura River
041 - Uganik River
150 - King Cove
151 - Port Moller
052 - Dutch Harbor
053 - Akutan
054 - Sand Point
055 - Bear River, ADF&G Camp
056 - Nelson River, ADF&G Camp
057 - Canoe Bay

Appendix B.4 Measuring fish length, mid-eye to fork of tail.



Mid-eye to fork lengths are taken because the length and shape of a salmon's snout changes as it approaches sexual maturity. The procedure for measuring by this method follows:

- 1) Place the salmon flat on its right side, with its head to your left and the dorsal fin away from you.
- 2) The eye should be on the line projecting from the end of the meter stick. Hold the head in place with your right hand. Sometimes you can control the fish better by placing your thumb in the fish's mouth.
- 3) Flatten and spread the tail against the board with your right hand.
- 4) Read the mid-eye to fork length to the nearest millimeter.

As soon as possible after completion send the samples and mark-sense forms to the office in Kodiak. During scheduled radio calls before sending the data in, the crew leader will notify the area biologist: 1) that the data is being mailed (use a moisture-proof container); 2) what data is being sent; 3) when delivery is expected in Kodiak; and 4) who is transporting the data. It is important that these steps are followed to ensure delivery.

Reminders

- 1) AWLs should be carefully edited. Re-check header information on AWLs; make sure all available information is filled in. Take extra care to use the correct statistical week for the sampling or catch date. Page numbers should not be repeated; a frequent error is to begin a week's sample with the last page number used the week before. Take time to ensure that the boxes are being blackened correctly. Keep marks within each rectangle and completely fill them. After AWLs are edited, place editor's initial next to page number, but not in left margin. Before sending data forms in, look down the form from two angles to pick up any glaring mistakes.
- 2) Mount the scales correctly, with anterior end (arches up) toward top of scale card with the ridged (rough) side out.
- 3) Make sure the error codes are correct. Error code 7 is wrong species, error code 8 is non-preferred scale. Error code 6 is for the use of the scale reader, it refers to the reabsorption of the scale.
- 4) Transfer important comments from scale cards to AWLs. Important remarks can be lost; after pressing scales, the cards are seldom referred to again. Write comments in the top margin (not on the left side). If there is not room on the AWL to completely explain the remarks, use a separate piece of paper.
5. Never put data from different dates on one AWL or one scale card. Even if only one scale is collected that day, begin a new card and AWL for the next day.
6. If weights are taken be sure to transfer the weights and litho codes to the appropriate columns on the reverse of the AWL before submitting it to the office.
7. If possible Keep the litho code in order. The data processing program uses the "litho code" to track the data files. (It is located in the lower left margin of the AWL.) Keep them in order before numbering the pages.
8. Recopy all wrinkled or splotched AWLs before sending them in. The optical scanning computer will misread, reject, or destroy damaged sheets.

The responsibility for accuracy lies first with the primary data collector(s). Sloppy or incomplete data will be returned to individual collectors. Compliance with the sampling procedures and schedule will be noted in each samplers evaluation.

OPERATIONAL PLAN
ALITAK BAY JUNE SOCKEYE SALMON
TEST FISHERY FOR 1991

Alaska Department of Fish and Game
Division of Commercial Fisheries
211 Mission Road
Kodiak, Alaska 99615

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INTRODUCTION

In the Alitak Bay District of the Kodiak Management Area there are two early sockeye runs which are the Upper Station Lakes run and the Frazer Lake run. Both occur simultaneously. The Frazer Lake run is usually dominate. Both runs contribute to important west side Kodiak salmon fisheries mainly in the Alitak Bay District in June and early July. A reliable in-season estimate of the early run strength to these systems is necessary to maximize harvest potential and ensure optimum escapement. Currently the primary in-season method for assessing run strength is a combination of the escapement counts at the Dog Salmon and Upper Station weirs, aerial surveys of escapement build-up on the Dog Salmon River flats, and the 9 June Alitak Bay District commercial catch. The information has not always been timely enough to ensure maximum harvest and optimum escapement. An in-season test fishery in conjunction with scale pattern analysis in upper Moser Bay should provide an accurate in-season measure of the run strength and timing of the Frazer Lake and Upper Station early run stocks.

OBJECTIVES

1. In-season estimate the daily early sockeye run number to Upper Station Lakes and Frazer Lake combined from the upper Moser Bay test fish catch.
2. Periodically, in-season, estimate the composition of Frazer Lake and early Upper Station fish in the Moser Bay test fish and Alitak Bay District catch through scale pattern analysis.

PROCEDURES

Test fishing will be conducted daily from 29 May through 15 July on the northeast side of Chip Cove in upper Moser Bay (Figure 1). A standard 50 fathom, 40 mesh deep, 4.75 inch stretch gill net will be fished daily at the location for three hours irrespective to whether a commercial opening is in progress. The daily set will begin on the flood 1.5 hrs. before high tide and end on the ebb 1.5 hrs. after high tide. The sequence will be to fish every other high tide except that there will be no night fishing. When a high tide at night falls with the sequence, the previous high tide will be fished, and the sequence of fishing every other tide will re-start from that tide. Fishing will be discontinued during a set if more than 200 sockeye salmon are in the net. In addition to the catch, associated climatological and fishing conditions will be recorded on the form in Figure 2.

The gillnet used in the test fishery will be maintained in good condition throughout the season. Therefore daily, the gillnet will be inspected, cleaned, and repaired as required to ensure the net is in good fishing condition.

All set net caught fish will be sold to the processor at Lazy Bay. The fish ticket receipts will be issued to the State of Alaska, Department of Fish and Game, Division of Commercial Fisheries, Kodiak. Prior to delivering the catch to the processor, the sockeye salmon will be catch sampled for age (two-scales per fish), length, and sex according to the procedures in Appendix A. Within 24 hours of sampling the scales will be aged.

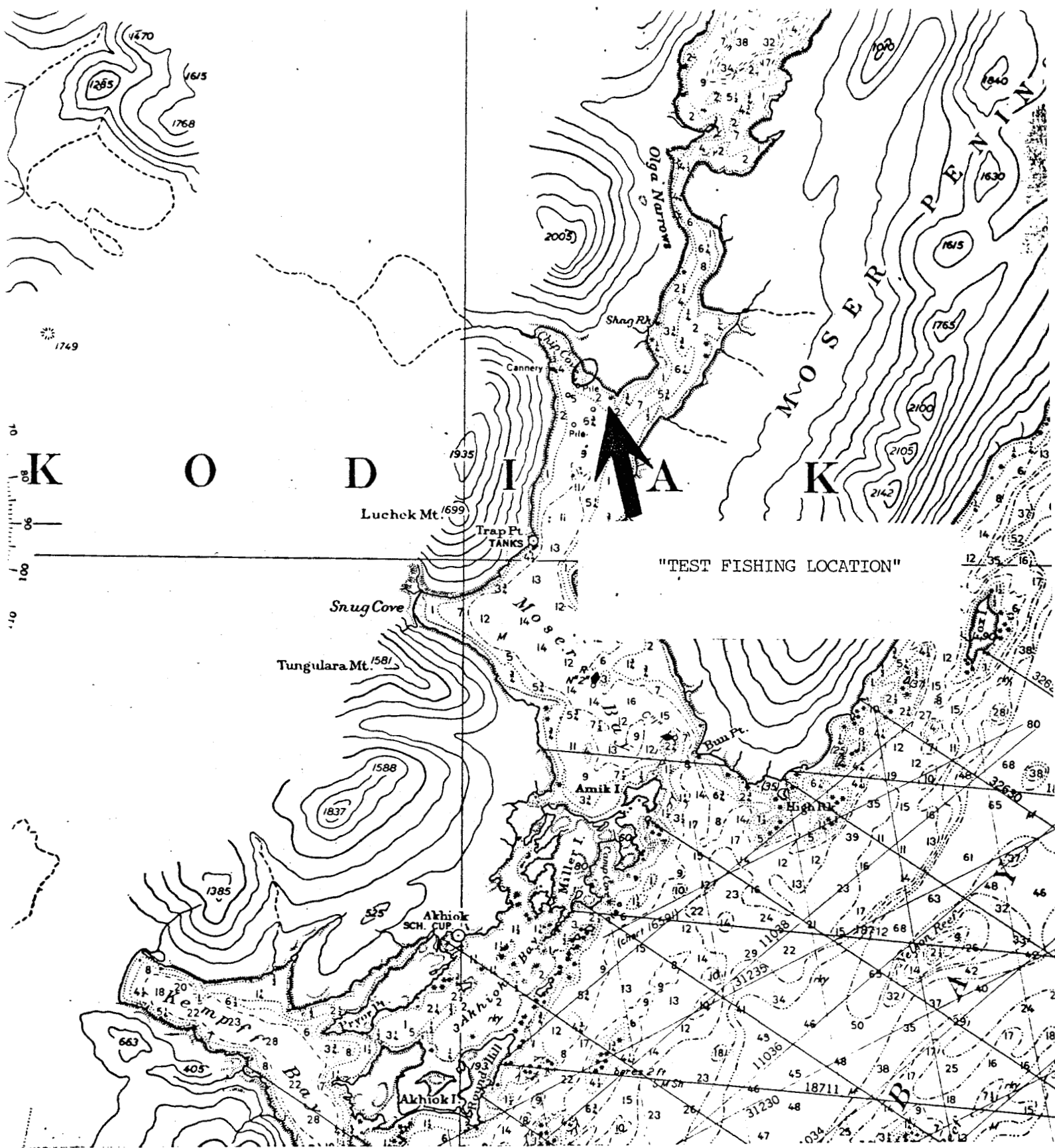


Figure 1. Map of Moser Bay with the location of the test fishing site identified.

SET NET SITE: _____

YEAR: _____

[illegible]

- 1/ Record to the nearest minute and specify a.m. or p.m.
- 2/ Use standard tide tables with correction factor for Cape Alitak. Record cloud cover to nearest 10%; wave height to nearest foot; wind direction from compass bearing; wind velocity to nearest 5 mph; and temperature to nearest degree.
- 3/ Note the travel direction for the majority of the fish hitting the net.

Linear discriminant analysis using scale measurements will be used to determine rivers origin of the sockeye salmon caught in the test fishery and Alitak District commercial catch. An age 2.2 stock separation model will be developed. The standards will be 200 age-2.2 scales from the 1991 early run Upper Station escapement and 200 age-2.1 scales from the 1990 Frazer Lake escapement. Age-2.2 fish are expected to comprise 53% of the Upper Station and 63% of the Frazer Lake runs in 1991 (Table 1). Age 1.3 stock model will also be developed. The standards will be 200 age 1.2 Upper Station and Frazer Lake scales sampled in the 1990 escapement. Age 1.3 fish are expected to be 24% of the Upper Station and 26% of the Frazer Lake run in 1991. The age specific scale impressions will be projected at 200X onto a digitizing tablet to measure the distances between circuli and record the number of circuli in the first freshwater annulus, and the second freshwater annulus. Once these variables are measured age 2.2 and 1.3 a stock separation models will be constructed that provide a high discrimination level between the Upper Station and Frazer Lake fish. In-season the age-2.2 and 1.3 discriminant models will be applied to successive aggregates of 100 (age specific) digitized unknowns from each sample to estimate the Frazer Lake and Upper Station components. All point estimates will be adjusted for misclassification errors using the procedure of Cook and Lord (1978), while 90% confidence intervals around the estimates will be computed using the procedure of Pella and Robertson (1979).

Stock compositions of test and commercial catches other than for the age-2.2 and age 1.3 fish will be estimated by combining the results from the scale pattern analysis with the age composition of the forecasted Upper Station and Frazer Lake runs (Table 1). The underlining assumption will be that the stock composition of the minor ages will be the same as estimated

Table 1. Age composition of the 1991 run forecast for Frazer Lake and early Upper Station sockeye salmon.

System	<u>Percent Age Composition</u>				Total Run Number
	1.2	1.3	2.2	2.3	
Frazer Lake	4.1	25.6	63.3	7.0	901,000
Early Upper Station	9.5	24.1	53.1	13.3	227,000

for the age-2.2 and age-1.3 combined. Stock composition estimates based on scale pattern analysis results will be made within 24 hours after the collection of each 100 fish age-2.2 and age 1.3 sample. The latest target date for the first stock composition estimate is 7 June. If a total of 100 or more age-2.2 and age 1.3 fish have not been caught in the test fishery by 5 June and provided the age discriminant models have been developed, test fishing time will be extended on 5 July until the required samples are obtained.

REPORTING

Daily, the catch data will be recorded on a standard form (Figure 2) and also radioed to the Department's Kodiak office via the 3230 frequency. The daily radio report will cover the number of fish caught by species and the total number of minutes fished. Age and stock composition estimates will be transmitted when requested.

Daily test fish catch reports will be publicly posted at Alitak.

LITERATURE CITED

- Cook, R. and G. Lord. 1978. Identification of stocks of Bristol Bay sockeye salmon by evaluating scale patterns with a polynomial discriminant method. U.S. Fish and Wildlife Service, Fisheries Bulletin 76(2): 415-423.
- Fishery, R. 1936. The use of multiple measurements in taxonomic problems. Annual Eugenics 7:179-188.
- Pella, J. and T. Robertson. 1979. Assessment of composition of stock mixtures. Fishery Bulletin 77(2):387-398.

APPENDIX A

Completion of mark sense A.W.L. forms

Length, Sex, and Scale Sampling Procedure for Sampling:
Using Mark-Sense Forms
(Recommended by Statewide Stock Biology Group, May 1985)

INTRODUCTION

Salmon from the catch are sampled for length, sex, and scales annually by field crews throughout the state. This data base is essential to sound management of the State's salmon resources. This information is drawn upon by management and research biologists for: (1) forecasting run strengths; (2) setting escapement goals; (3) examining the productivity of each system; (4) salmon growth analysis; (5) catch apportionment (based on age composition and/or scale pattern analysis); (6) in-season run estimation; and (7) to gain a better understanding of the biology of each stock.

For clarification purposes a SCALE SAMPLE and SUB-SAMPLE will be defined as follows:

SCALE SAMPLE: A data set collected from a specific sampling location, containing scales and data from a single species, collected during a single year. All data forms and scale cards of a single SAMPLE have the same statistical code. AWL and scale card number in a sample are consecutively and chronologically ordered.

SUB-SAMPLE: Any portion of a scale sample consisting of consecutively numbered AWL's and scale cards. SUB-SAMPLES usually consist of one or more time segments of a sample.

To be useful, data must be recorded on the mark-sense forms neatly and accurately. The following procedures are to be adhered to when sampling for length, sex, and scales using mark-sense AWL forms.

COMPLETING THE FORMS:

A completed mark-sense AWL form and accompanying gum card for sampling commercial catches of sockeye and chum salmon are shown in Appendix B.1. A completed AWL form and accompanying gum cards for sampling commercial catches of chinook and coho salmon are shown in Appendix B.2.

Complete each section of the left side of the mark-sense form using a soft No. 2 pencil and darken the corresponding blocks as shown in the figures. Make every effort to darken the entire block as partially filled blocks are often missed by the optical scanner which reads and records the data from the mark-sense AWL forms. Label only one form at a time to avoid "the carbon paper effect" and resulting stray marks.

Description:

For escapement sampling: Species/Area/Catch or Escapement/gear type i.e. weir/Samplers (name and W-R-P)

DO NOT WRITE IN THIS MARGIN

102661

AREA: Nelson Lagoon

Samplers: W. Tracy McKinnon
P. Jean Mitchell
R. Jim McCullough

Scale Readers: Tracy McKinnon

ADULT ADULT SALMON AGE LENGTH
FORM VERSION 2.1

CARD	100%	LENGTH	AGE GROUP	AGE READ CODE
083				
NEEDLE				
DAY CATCH DATE				
MONTH				
YEAR				
DISTRICT				
SUBDISTRICT				
STREAM				
LOCATION				
PERIOD				
PROJECT				
GEAR				
MESH				
TYPE OF LENGTH MEASUREMENT				
NUMBER SCALES FISH				
OF CARDS				

EXAMPLE

Fish # 1
Fish # 2
Fish # 3
Fish # 13
Fish # 14
Fish # 15
Fish # 25
Fish # 26
Fish # 27
Fish # 38
Fish # 39
Fish # 40

Appendix B-1. Example of AWL and gum cards for sampling one scale per fish.

Species: Sockeye Card No: 083
 Locality: Nelson Lagoon Catch
 Stat. Code: 313-30
 Sampling Date: Mo. 6 Day 26 Year 87
 Gear: Purse Seine
 Collector(s): McCullough, Mitchell, McKinnon
 Remarks: _____

1

DESCRIPTION: AREA: Moller to Senievin

Samplers: W - Tracy McKinnon
P - Jason Mitchell
R - Jim McCullough

Scale readers: McKinnon

ADPSS ADULT SALMON AGE LENGTH
FORM VERSION 2.1

DO NOT WRITE IN THIS MARGIN

103328

001
A, B, C,
Chinook
DAY (caught)
20
MONTH
6
YEAR
87
DISTRICT
315
SUBDISTRICT
NILEAN
LOCATION
Port Moller
PERIOD
PHASE
GEAR
TACKLE
TYPE OF
LENGTH
MEASUREMENT
NUMBER
SCALES
FISH
4
OF CARDS
1

100's
LENGTH
1's
AGE GROUP
AGE LENGTH CODE

Card 1 A
Card 1 B
Card 1 C

Fish 01
Fish 02
Fish 03
Fish 04
Fish 05
Fish 06
Fish 07
Fish 08
Fish 09
Fish 10
Fish 11
Fish 12
Fish 13
Fish 14
Fish 15
Fish 16
Fish 17
Fish 18
Fish 19
Fish 20

Appendix B.2. Example of AWL and gum cards for sampling more than one scale per fish.

Species: Chinook Card No: 001A
Locality: Moller to Senievin Catch
Stat. Code: 315
Sampling Date: Mo 20 Day 6 Year 87
Gear: purse seine
Collector(s): McKinnon, Mitchell, McCullough
Remarks: 3 scales per fish

Species: Chinook Card No 001B
Locality: Moller to Senievin
Stat. Code: 315
Sampling Date: Mo 20 Day 6 Year 87
Gear: purse seine
Collector(s): McKinnon, Mitchell, McCullough
Remarks: 3 scales per fish

Species: Chinook Card No 001C
Locality: Moller to Senievin Catch
Stat. Code: 315
Sampling Date: Mo 20 Day 6 Year 87
Gear: purse seine
Collector(s): McKinnon, Mitchell, McCullough
Remarks: 3 scales per fish

Card:

The AWL forms and corresponding gum card(s) are numbered sequentially by date throughout the season starting with 001. A separate numbering sequence will be used for each species, gear type, district, and geographic location. Consult your port supervisor for the current card number. Sockeye and chum samples will have only 1 card per AWL form as shown in Appendix B.1. Coho and chinook samples will contain up to four cards per AWL form as shown in Appendix B.2.

Species:

Refer to the reverse side of the AWL form for the correct digit.

Day, Month, Year:

Use appropriate digits for the date the fish are caught.

District:

List only one district. Consult project leader for appropriate district, subdistrict, and stream numbers.

Subdistrict:

List a single subdistrict if it is known and all the fish sampled were from that single subdistrict. Leave blank if more than one subdistrict is involved or if the subdistrict is unknown.

Stream:

Leave blank for catch sampling; for escapement sampling consult project leader for appropriate number.

Location:

List the appropriate code as shown on Table B.1.

Period:

List the statistical week in which the fish were caught (Table B.2).

Project:

Refer to the reverse side of the AWL form for the correct code.

Gear:

Refer to the reverse side of the AWL form.

Mesh:

Leave blank unless specifically instructed by supervisor to do otherwise.

Type of length measurement:

Use (2) mid-eye to fork-of-tail (unless specifically instructed to do otherwise). Refer to Appendix B.3.

Table B.1. Assigned port and weir location codes. (Use under location in filling out AWL's for catch and escapement sampling.)

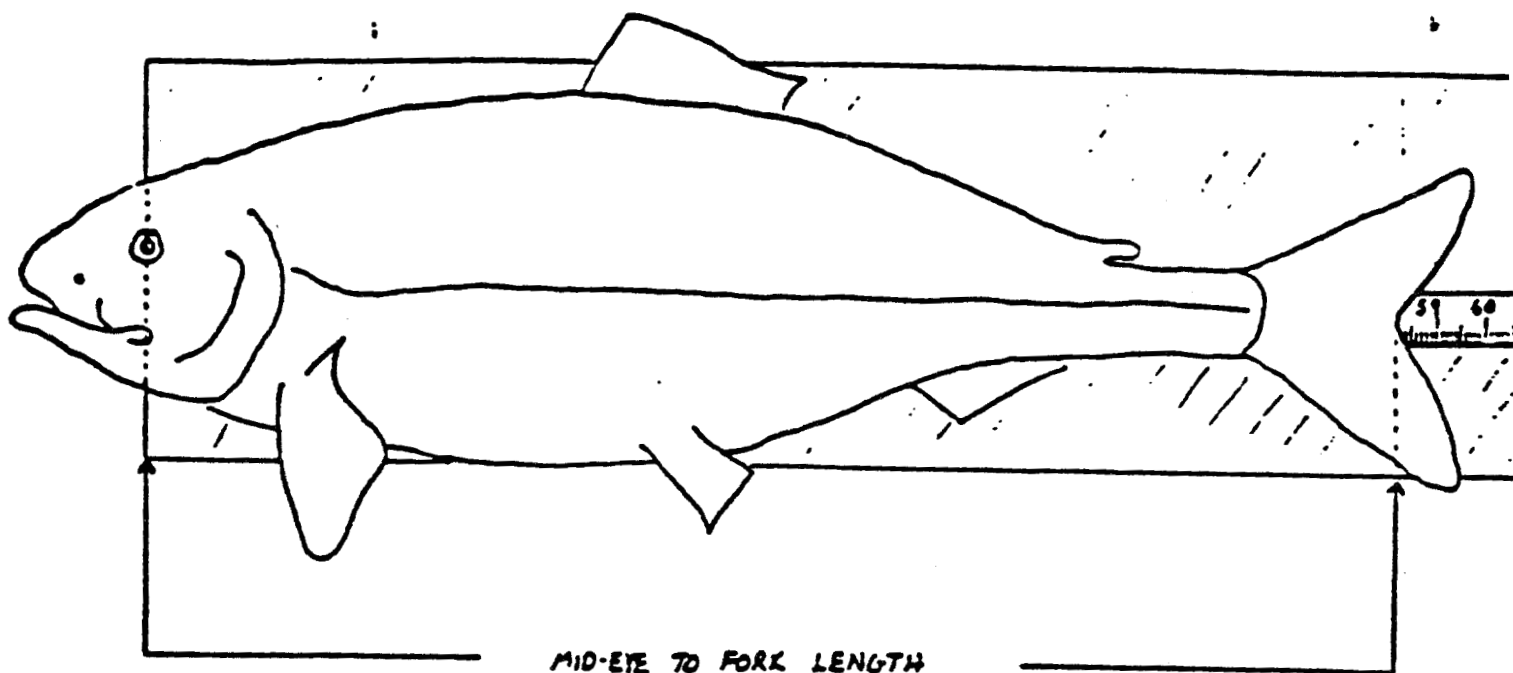
Port Codes

001 - Pelican
 002 - Elfin Cove
 003 - Sitka
 004 - Juneau
 005 - Petersburg
 006 - Ketchikan
 007 - Craig
 008 - Port Alexander
 009 - Metlakatla
 010 - Excursion Inlet
 011 - Hoonah
 012 - Wrangell
 013 - Out of State
 014 - Kake
 015 - Gedney
 016 - Security Bay
 017 - Meyers
 018 - Pt. Baker
 019 - Klawock
 020 - Yakutat
 030 - Lazy Bay
 031 - Port of Kodiak
 032 - Pauls Lake
 033 - Thorshiem
 034 - Afognak River
 035 - Karluk River
 036 - Red River
 037 - Upper Station
 038 - Frazer Lake
 039 - Dog Salmon
 040 - Akalura River
 041 - Uganik River
 150 - King Cove
 151 - Port Moller
 052 - Dutch Harbor
 053 - Akutan
 054 - Sand Point
 055 - Bear River, ADF&G Camp
 056 - Nelson River, ADF&G Camp
 057 - Canoe Bay

Table B.2. Statistical weeks and corresponding calendar dates for 1991.

Statistical Week	Calendar Dates	Statistical Week	Calendar Dates
1	01-Jan to 05-Jan	28	07-Jul to 13-Jul
2	06-Jan to 12-Jan	29	14-Jul to 20-Jul
3	13-Jan to 19-Jan	30	21-Jul to 27-Jul
4	20-Jan to 26-Jan	31	28-Jul to 03-Aug
5	27-Jan to 02-Feb	32	04-Aug to 10-Aug
6	03-Feb to 09-Feb	33	11-Aug to 17-Aug
7	10-Feb to 16-Feb	34	18-Aug to 24-Aug
8	17-Feb to 23-Feb	35	25-Aug to 31-Aug
9	24-Feb to 02-Mar	36	01-Sep to 07-Sep
10	03-Mar to 09-Mar	37	08-Sep to 14-Sep
11	10-Mar to 16-Mar	38	15-Sep to 21-Sep
12	17-Mar to 23-Mar	39	22-Sep to 28-Sep
13	24-Mar to 30-Mar	40	29-Sep to 05-Oct
14	31-Mar to 06-Apr	41	06-Oct to 12-Oct
15	07-Apr to 13-Apr	42	13-Oct to 19-Oct
16	14-Apr to 20-Apr	43	20-Oct to 26-Oct
17	21-Apr to 27-Apr	44	27-Oct to 02-Nov
18	28-Apr to 04-May	45	03-Nov to 09-Nov
19	05-May to 11-May	46	10-Nov to 16-Nov
20	12-May to 18-May	47	17-Nov to 23-Nov
21	19-May to 25-May	48	24-Nov to 30-Dec
22	26-May to 01-Jun	49	01-Dec to 07-Dec
23	02-Jun to 08-Jun	50	08-Dec to 14-Dec
24	09-Jun to 15-Jun	51	15-Dec to 21-Dec
25	16-Jun to 22-Jun	52	22-Dec to 28-Dec
26	23-Jun to 29-Jun	53	29-Dec to 31-Dec
27	30-Jun to 06-Jul		

Appendix B.3. Measuring fish length.



Because the length and form of the snout of salmon changes as the fish approaches sexual maturity, length measurements are made from the middle of the eye to the fork of the tail. The length is always recorded to the nearest millimeter. The procedure for measuring length (mid-eye to fork) of the salmon is as follows:

1. Place the salmon flat on the board with the head to your left and the dorsal fin away from you.
2. Make sure your eye is directly over the end of the board. Line the eye of the salmon up with the edge of the board and hold the head in place with your left hand. It helps to place a finger in the salmon's eye for reference.
3. Flatten and spread the tail against the board with your right hand.
4. Read the mid-eye to fork length to the nearest millimeter .

of cards:

Mark 1 when sampling sockeye, chum, coho, and chinook salmon (Appendix B.1). When sampling chinook and coho salmon write the card numbers (i.e. 001A, 001B, 003B, etc.) perpendicular to the left of the fish # column as shown in Appendix B.2.

It is paramount to keep the mark-sense forms flat, dry, and clean. Fish gurry and water curling will cause data to be misinterpreted by the optical scanning machine. In general, keep the forms neat enough and legible enough to have a stranger be able to make sense out of them.

Additional data columns are available on the reverse of the AWL for individual project use. If you as a project leader use them and wish that data to be read by the opscan reader, you will need to transfer the litho code from the front of the form to the reverse.

GUM CARD(S):

Fill out the gum cards as shown in Appendices B.1 and B.2.

Species:

Write out completely (i.e., chinook, sockeye, etc.).

Locality:

For catch sampling and escapement sampling write down area in which fish were caught followed by the word catch or escapement (i.e. Karluk River escapement).

Stat. code and Sampling date:

Transfer the appropriate digits from the AWL form.

Gear:

Write out completely.

Collector(s):

Record the last name or initials of the person(s) sampling.

Remarks:

Record any pertinent information such as number of scales per fish sampled, vessel/tender name, etc. Transfer this same information to the top margin of the AWL.

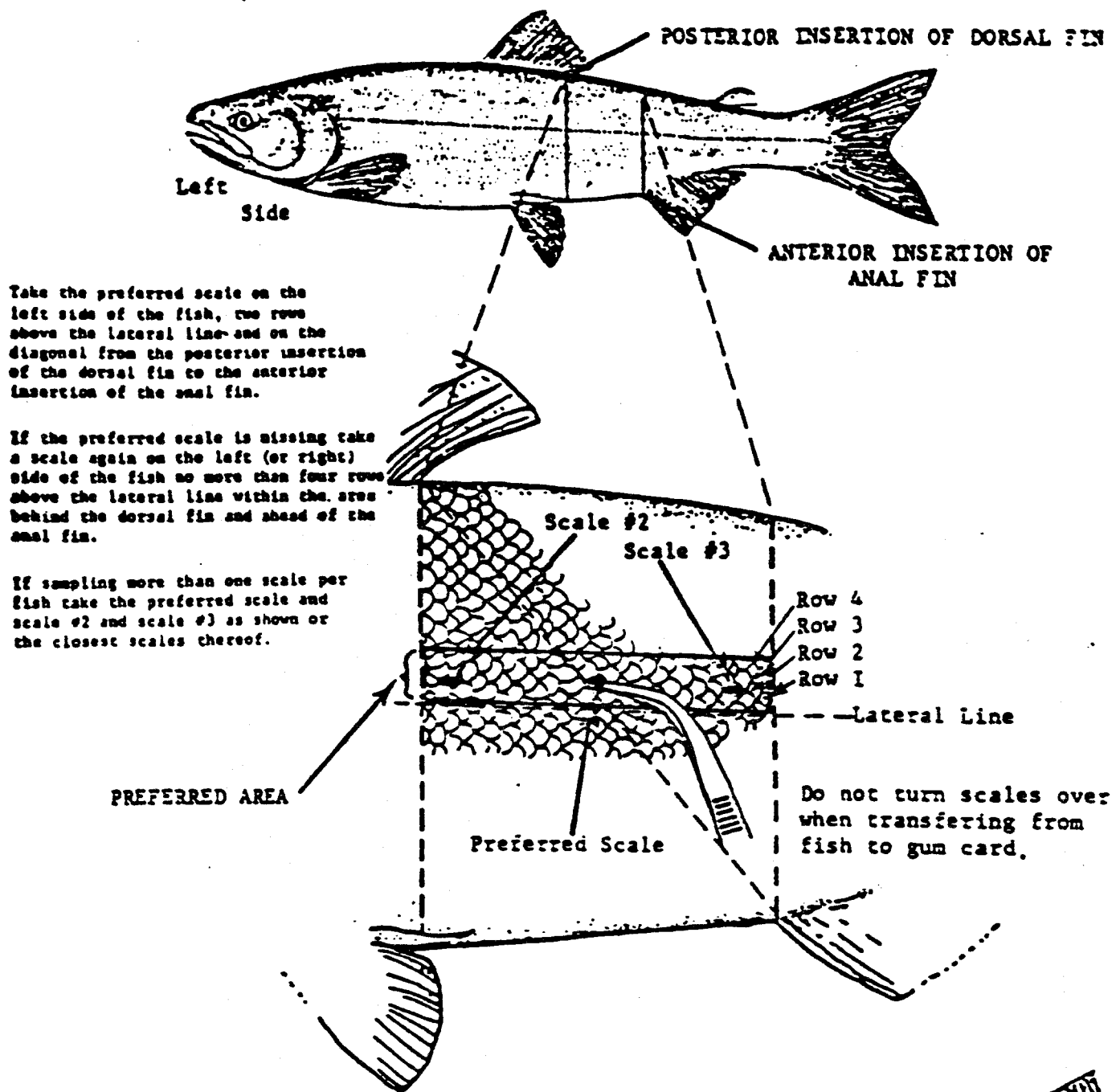
SAMPLING:

A. GENERAL

1. Sex the fish and darken M or F in the sex columns. If any difficulty was encountered in this procedure, write "I had trouble sexing these fish" on the top margin of the AWL and ask your supervisor for help as soon as possible before sexing additional fish.

2. Measure all species' length in millimeters from the middle of the eye to the fork of the tail, refer to Appendix B.3. Record length by blackening the appropriate column blocks on the AWL form. Column 3 on the AWL form is used for fish over 999 millimeters long (Big Daddy Chinook). Measure all species of salmon to the nearest mm. Check the calipers daily, before use, to ensure the accuracy of the measurements.
3. Pluck the "preferred scale" from the fish using forceps. Remove all slime, grit, and skin from the scale by moistening and rubbing between fingers. The "preferred scale" is located on the left side of the fish, two rows above the lateral line on the diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin, refer to Appendix B.4. If the "preferred scale" is missing, select a scale within the preferred area on either the left or right side of the fish. If no scales are present in the "preferred area" on both sides of the fish, sample a scale as close to the preferred area as possible and darken the 8 under "age error code" on the AWL form.
4. Clean, moisten and mount scale on gum card directly over number 1 as shown in Appendix B.4. The side of the scale facing up on the gum card is the same as the side facing up when it was adhered to the fish. This outward facing side is referred to as the "sculptured" side of the scale. The ridges on this sculpture side can be felt with a fingernail or forceps. Mount scale with anterior end oriented toward top of gum card.
5. When sampling sockeye and chum salmon repeat steps 1 through 4 for up to 40 fish on each AWL form.
6. When taking multiple scales per fish as with chinook and coho salmon sample the "preferred scale" and scale #2 as shown in Appendix B.4. Scale #2 is one inch to the left of the "preferred scale," and is 2 rows above the lateral line. Mount the 2 scales from fish #1 over 1 and 11 on the gum card as shown in Appendix B.2. Continuing, mount the 2 scales from fish #2 over 2 and 12, etc. If sampling 3 scales, mount the scales over #1, #11, #21, etc.
7. Use plastic scale card holders to hold individual scale cards during sampling and cover the completed gum card with wax paper for storage.
8. When sampling a weired system you may use write in rain books to record the data. Keep the mark-sense forms in camp where they will be clean, dry, and flat. After sampling is done for the day transfer the data to the mark-sense forms. It is the responsibility of the data collector to transcribe the data before turning it over to the ARB.
9. Miscellaneous:
 - a. When scales are sampled in wet conditions it is difficult to mount scales in a fashion so as to result in a good scale impression being made. Glue often obscures scale

Appendix B.4. Scale sampling procedure showing the preferred scale sampling area on an adult salmon.



NOTE: Mount scales with anterior portion of scale oriented toward top of card.

Place scales directly over number on gum card.

10	9	8	7	6	5	4	3	2	1
20	19	18	17	16	15	14	13	12	11
30	29	28	27	26	25	24	23	22	21
40	39	38	37	36	35	34	33	32	31

features and scales frequently adhere poorly to the card. In this situation the scales should be remounted.

- b. For adipose clipped fish record the head tag number on the corresponding row in the first five columns on the reverse side of the AWL.
 - c. Look down the form from two angles after the data has been recorded to pick up any glaring mistakes. A common error occurs, for instance, in placing both the 4 and 7 of a 475 mm fish in the 100's column with nothing in the 10's column.
 - d. Keep all fish gurry off forms and erase any stray marks on the forms before turning them in to your supervisor.
 - e. Write in all comments explicitly and completely under remarks, transfer remarks to top margin of AWL.
 - f. Responsibility for accuracy lies first with the primary data collector(s). The port supervisor will return sloppy or incomplete data to individual collectors. After editing a form, place your initials next to card #, but not in left margin.
10. As soon as possible after completion send the samples and mark-sense forms to the ARB in Kodiak. During scheduled radio calls before and following the sending of data to the ARB, the crew leader will notify the ARB: 1) that the data is being mailed (use a moisture-proof container); 2) what data is being sent; 3) when delivery is expected in Kodiak; and 4) who is transporting the data. It is important that these steps are followed to ensure delivery.

B. SAMPLING SCENARIOS:

1. Differing size crews:

- a. One person: Wrestle the fish into the measuring board, wearing a glove on one hand. Measure the fish and write the sex and length down on the measuring board to be transferred to the AWL after ten fish have been measured. Next, pluck the preferred scale(s), clean, and mount on the gum card which is taped to the AWL in the clipboard which is sitting on the end of the measuring board. After ten fish have been processed, remove the glove and record the sexes and lengths on the AWL with your clean hand. A slime rag may be helpful.
- b. Two persons:
 - (1) When sampling more than one scale per fish, one person can wrestle the fish and record data while the other plucks and mounts scales. The wrestler needs to wear a glove that he can slip off his writing hand to record the sex and length data on the AWL form.

- (2) When sampling one scale per fish, the person plucking the scales also records the data.
 - c. Three persons: One person wrestles the fish, one plucks and mounts the scales, and the third records the data.
2. Sampling tote to tote:
- a. When sampling for 2 or 3 scales per fish (chinook and coho) use two persons.
 - b. When sampling for 1 scale per fish (sockeye and chum) use three persons, if available.

SCALE SAMPLING CHECKLIST

Clipboard	Pencils (No.2)	Gloves
Gum Cards	Forceps	Measuring board or calipers
AWL's	Wax paper inserts	Sampling Manual
	Plastic scale card holders	

Some Reminders

1. For greater efficiency in scale reading and digitizing, mount scales with anterior end toward top of scale card.
2. AWLs should be carefully edited. Re-check header information on AWLs; make sure all available information is filled in. Take extra care to use the correct statistical week for the sampling or catch date. Page numbers should not be repeated; a frequent error is to begin a week's sample with the last page number used the week before. This is particularly important if the data is regularly sent to town; it is easy to forget which numbers were used. Crew leaders should take time to ensure that the boxes are being blackened correctly, if the boxes are sloppily marked the optical scanner records the information incorrectly or misses it entirely. Keep marks within each rectangle and completely fill them. After AWLs are edited, place editor's initial next to page number, but not in left margin.
3. Check to make sure error codes are being used correctly, i.e. error code 7 is wrong species, error code 8 is non-preferred. Error code 6 is for the use of the scale reader, it refers to the reabsorption of the scale.
4. Transfer important comments from scale cards to AWLs. After pressing scales, the cards are seldom referred to again, and important remarks can be lost. Write comments in the top margin (not on the left side) or on the reverse of the AWL. If there is not room on the AWL to completely explain the remarks, use a separate piece of paper.
5. Never put data from different dates on one AWL or one scale card. Even if only one scale is collected that day, begin a new card and AWL for the next day.
6. If weights are taken, they may be noted in the right margin of the AWL during sampling, but be sure to transfer the weights to the appropriate columns on the reverse of the AWL before submitting it to the ARB.
7. The data processing program uses the "litho code" on the AWL. (It is located in the lower left margin of the AWL.) It helps if the AWLs are used in the order of this code. It should not be hard to keep them in order if they are arranged that way before page numbering. Those who sample different areas throughout the season can arrange the litho codes in order before each sample is taken.
8. If AWLs get wrinkled or splotted they should be copied over before sending in. The optical scanning computer will misread or reject wrinkled sheets.

APPENDIX B

Fish Identification Keys

A UNITED STATES
DEPARTMENT OF
COMMERCE
PUBLICATION



NOAA Technical Report NMFS CIRC-366

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

Key to Field Identification of Anadromous Juvenile Salmonids in the Pacific Northwest

ROBERT J. McCONNELL and GEORGE R. SNYDER

SEATTLE, WA.
January 1972

Key to Field Identification of Anadromous Juvenile Salmonids in the Pacific Northwest

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ABSTRACT

A key is presented with descriptive illustrations to help in field identification of live, juvenile salmonids in fresh waters of the Pacific Northwest. Other juvenile fish that may be mistakenly identified as salmonids are included.

INTRODUCTION

Species identification of live, anadromous juvenile salmonids is frequently a problem to the field biologist. The purpose of this key is to list and illustrate the external characteristics which will expedite field identification of juvenile salmonids in the Pacific Northwest.

Five species of Pacific salmon (pink, chum, sockeye, chinook, and coho); four species of trout (cutthroat, brown, Dolly Varden, and rainbow or steelhead); and other juvenile and adult fish¹ that may be mistaken for salmon or trout in fresh water are described in this key.

USE OF KEY

The characteristics for identification are listed in a series of alternative statements, some of which are illustrated. To use the key, examine the first statement; if applicable, proceed to the next and continue to successive statements until the species is identified. If a statement is not applicable, pass to the alter-

native characteristics indicated by numbers in parentheses (numbers on the drawings correspond to numbers of statements in the key). Continue in this manner until the specimen is identified. Some external characteristics are positive separating features (marked with asterisk), whereas others are not. Therefore, two or more statements should be considered before final rejection. If a precise identification cannot be made using the external characteristics—and the fish can be sacrificed, a positive identification can usually be made from internal features (marked with double asterisks). A bibliography of keys that utilize more descriptive internal characteristics is included in this paper.

KEY

1. (47) Adipose fin and scales present.
(Fig. 1)
2. (48) Fleshy appendage at base of pelvic fins present.
3. (49) Mouth large, reaching at least to center of eye.

Family Salmonidae

¹ Especially adult smelt, family Osmeridae.

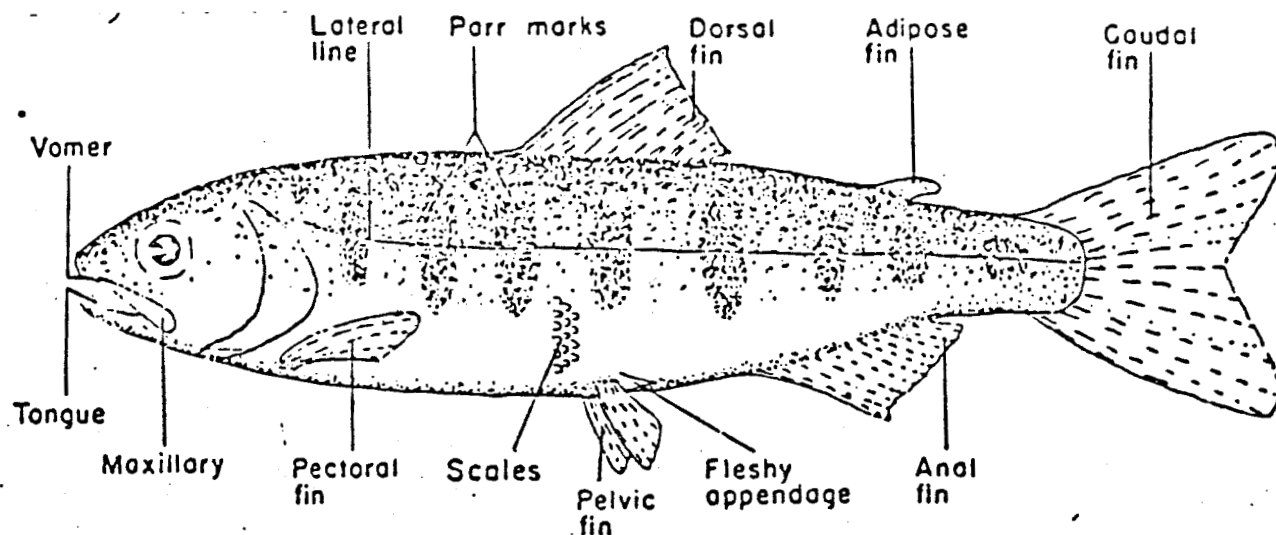
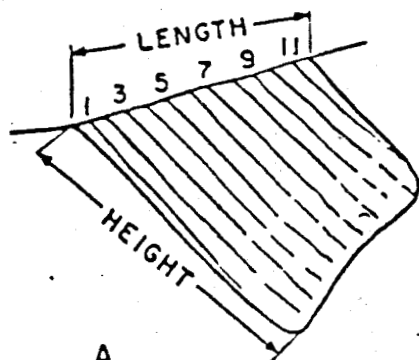
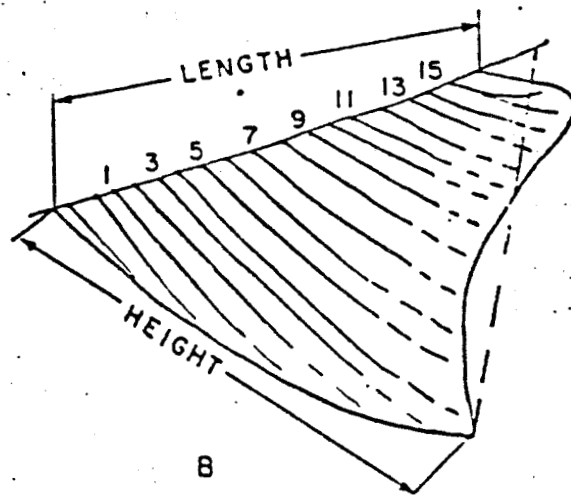


Figure 1.—A hypothetical salmonid showing external characteristics.

4. (17) Anal fin higher than long, with 8 to 12 developed rays (Fig. 2A)
5. (52) *Teeth on head and shaft of vomer. (Fig. 3A)

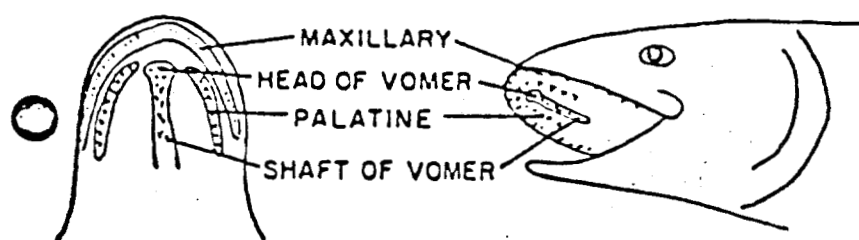


A
Genus Salmo

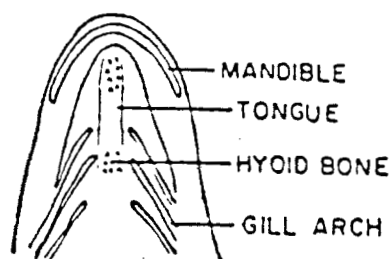


B
Genus Oncorhynchus

Figure 2.—Anal fins: (A) Trout, genus *Salmo*; (B) Pacific salmon, genus *Oncorhynchus*. The two drawings show differences in structure and fin ray count. (Note that the length of the anal fin is its overall basal length, and its height is that distance from the origin of the fin to the tip of the anterior lobe. In counting fin rays, include only those which originate from the base and terminate at the outer margin of the fin or are half as long as [or greater than] the longest ray.)



A

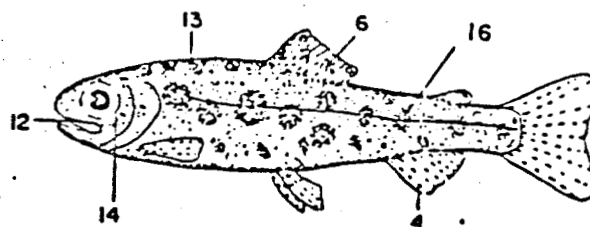


B

Figure 3.—Location of dentition in (A) the roof and (B) the floor of the mouth of salmonid fishes. (Presence or absence of teeth on the vomer or tongue may be determined by use of the little finger or a blunt instrument. The small hyoid teeth at the base of the tongue are located between the gill arches of the lower jaw and are difficult to find.)

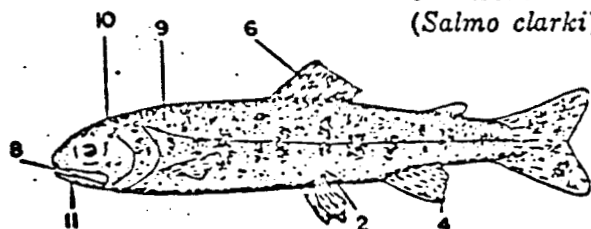
6. (18) Dorsal fin with large dark spots.
Trout
Genus *Salmo*

16. (20) Parr marks almost round.
Rainbow or
steelhead trout
(*Salmo gairdneri*)



7. (53) Adipose fin not orange; no row of pale round spots along lateral line.
8. (12) *Small hyoid teeth at base of tongue. (Fig. 3B)
9. (13) Not more than five parr marks on mid-dorsal ahead of dorsal fin.
10. (14) Maxillary reaching past posterior margin of eye.

1. (15) Red or yellowish hyoid mark under lower jaw. Tail usually black spotted.
Cutthroat trout
(*Salmo clarki*)

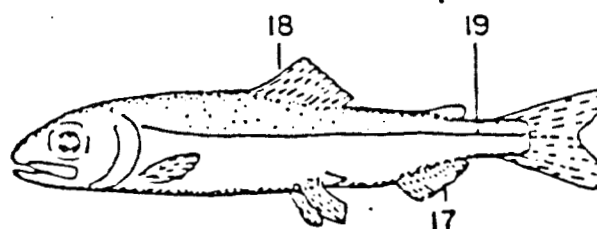


17. (4) Anal fin longer than high, with 13 or more developed rays. (Fig. 2B)
18. (6) Dorsal fin without large dark spots, may be black tipped.

Pacific salmon
Genus *Oncorhynchus*

19. (20) No parr marks. Fry leave fresh water while small—approximately 1.75 inches (45 mm) long.

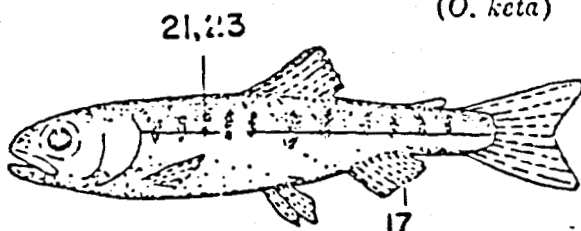
Pink salmon
(*O. gorbuscha*)



12. (8) *No teeth at base of tongue.
13. (9) Five to 10 parr marks along mid-dorsal ridge ahead of dorsal fin.
14. (10) Maxillary short, not reaching past posterior margin of eye.
15. (11) No hyoid mark under lower jaw. Few or no spots on tail.

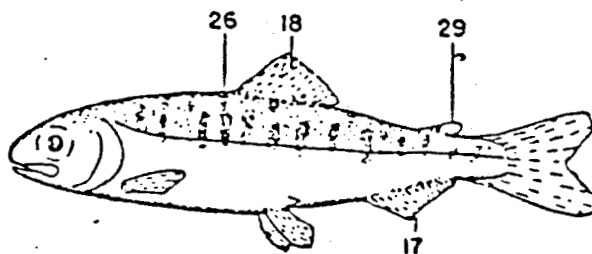
20. (16) Parr marks present as vertical bars or oval spots.
21. (30) Parr marks short, extending little, if any, below lateral line.
22. (25) Gill rakers on first arch, 19 to 26.
** Pyloric caeca, 140 to 186.
23. (26) Parr marks faint. Sides below lateral line iridescent green.
24. (27) Small when migrating from fresh water, approximately 1.5 inches (40 mm) long.

Chum salmon
(*O. keta*)



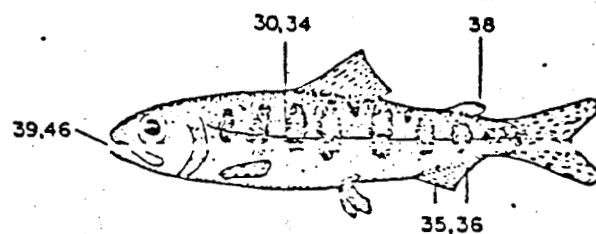
25. (22) Gill rakers on first arch, 30 to 40.
**Pyloric caeca 60 to 115.
26. (23) Parr marks usually sharply defined. Sides below lateral line silvery, not iridescent green.
27. (24) Relatively large when migrating from fresh water, approximately 3 to 5 inches (80 to 126 mm) long.
28. (31) Gill rakers long and slender, more than 29 on first arch.
29. (32) Adipose fin clear, not pigmented.

Sockeye salmon
(*O. nerka*)



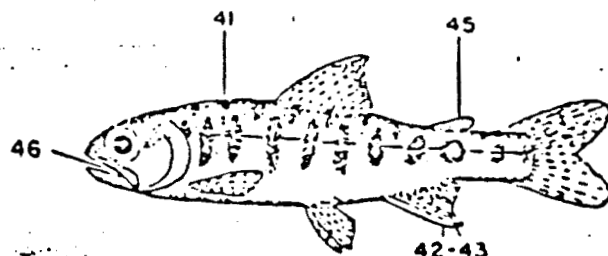
30. (21) Parr marks large, vertical bars centered by lateral line.
31. (28) **Gill rakers short and thick, fewer than 29 on first arch.
32. (29) Adipose fin at least partially pigmented.
33. (40) **Pyloric caeca more than 90.
34. (41) Parr marks broader than interspaces.
35. (42) Anterior rays of anal fin not distinctly longer than rest, not white edged.
36. (43) Anal fin not pigmented.
37. (44) Black spots, when present, on both lobes of caudal fin.
38. (45) Adipose fin not completely mottled, clear area at anterior base of fin.
39. (46) Black gums along base of lower teeth.

Chinook salmon
(*O. tshawytscha*)



40. (33) **Pyloric caeca less than 80.
41. (34) Parr marks narrower than interspaces.
42. (35) Anterior rays of anal fin elongated; when depressed they extend to base of last ray. (Fig. 2B)
43. (36) Anal fin pigmented between rays, resulting in black banding.
44. (37) Black spots, when present, on upper lobe of caudal.
45. (38) Adipose fin completely pigmented.
46. (36) Mouth gray to white.

Coho salmon
(*O. kisutch*)



47. (1) Adipose fin not present; scales present or lacking.

Not Salmonidae

48. (2) No fleshy appendage at base of pelvic fins.

Smelts

Family Osmeridae

49. (3) Mouth small, not reaching center of eye; teeth weak or absent.

50. (51) Depressed dorsal fin, shorter than head.

Whitefishes

Genus *Coregonus*

51. (50) Depressed dorsal fin, longer than head.

Arctic grayling

(*Thymallus arcticus*)

52. (5) **Teeth on head of vomer only.

Charrs

Genus *Salvelinus*

Dolly Varden (*S. malma*)

53. (7) Adipose fin orange; row of distinct pale round spots along lateral line.

Brown trout

(*Salmo trutta*)

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GPO 77

Illustrated Keys to the Fresh-water Fishes of Alaska

By JAMES E. MORROW

Published by
Alaska Northwest Publishing Company
Anchorage, Alaska

7

Introduction

This booklet includes all the fishes so far known to inhabit or to occur occasionally in the fresh waters of Alaska. Some of them are strictly fresh-water forms, never found in the sea. Others are normally marine species that sometimes move up the mouths of rivers into brackish or even into fresh water. A fairly large number are anadromous, spending much of their lives in the sea but returning to fresh water to breed, and still others are found mainly in fresh water but may move downstream in the fall and spend the winter in the sea or in brackish water around the river mouths.

The keys in this booklet are designed to provide as simple a means of identification as possible. For

each species, a brief discussion of its range has been included, as well as an outline sketch showing the important features of the fish. Many of our fishes have ranges that extend far beyond the borders of the state, but an identification made far outside the geographical areas given here should be regarded with suspicion. If possible, send such fishes to the author for further checking. Every effort has been made to insure accuracy in these keys. If errors are discovered, the author will appreciate learning of them.

Various versions of these keys have been tested, over a period of years, by the author's classes in ichthyology at the University of Alaska. Grateful

appreciation goes to these students for their continued interest and patience. Considerable use has been made of previous works, and a great deal of information on distribution has been gleaned from the altogether excellent book, "Freshwater Fishes of Northwestern Canada and Alaska," by J.D. McPhail and C.C. Lindsey. Anyone wanting detailed information on the life histories and general biology of northern fresh-water fishes is urged to consult that book, although not all of our Alaskan fishes are included in it.

The arrangement of groups and the scientific and common names used follow, with a few exceptions, the 1970 recommendations of the American Fisheries Society's Committee on Names of Fishes.

To the extent possible, technical terms have been avoided. However, sometimes such terms must be used. There are no other simple ways of identifying some structures. Therefore, a glossary of the technical terms employed, and sketches illustrating most of them, have been included.

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Dr. Morrow took his undergraduate studies at Middlebury College and his Ph.D. at Yale. After obtaining his doctorate, he led four expeditions for Yale's Bingham Oceanographic Laboratory, studying fishes in New Zealand, East Africa, South America and the western Indian Ocean. In 1960 he became Associate Professor of Fisheries at the University of Alaska, Fairbanks. For the past 14 years he has worked with the fishes of Alaska, guiding both undergraduate and graduate students in fish-related studies and, as Professor of Zoology, pursuing his own research on the fishes of the North.

He is the Ichthyological Editor of COPEIA, the journal of the American Society of Ichthyologists and Herpetologists, and is the editor of the BIOLOGICAL PAPERS OF THE UNIVERSITY OF ALASKA.

Glossary

Adipose fin—a small fin-like structure, fleshy and without supporting elements, located on the mid-line of the back between the dorsal fin and the tail. See *Fig. 1*.

Anal fin—an unpaired fin located on the mid-line of the belly, behind the anus. See *Fig. 1*.

Anterior—forward; toward the head.

Axillary process—an enlarged, more or less elongate scale found in the angle between the body and the pelvic fin of some fishes. See *Fig. 1*.

Caudal fin—the tail fin. See *Fig. 1*.

Dorsal—above; toward the back.

Dorsal fin—an unpaired fin located on the mid-line of the back. Sometimes in several parts. See *Fig. 1*.

Gill rakers—bony projections on the anterior side of the gill arches. Gill raker counts are those of the first arch on the left side, and are given either as the total count or as the counts of the upper and lower parts of the arch separately (*i.e.*, 11–18). In such a case, a raker at the

angle of the arch is counted with the lower part. See *Fig. 2*.

Interorbital or interorbital space—the distance between the eyes, measured in a straight line across the top of the head.

Lateral line—a sense organ that detects (among other things) low frequency vibrations. Appears as a row of pores, generally along the middle of the side of the body. See *Fig. 1*.

Maxillary—the rear-most bone of the upper jaw. See *Fig. 1*.

Opercle—the gill cover. See *Fig. 1*.

Palatines—a pair of bones in the roof of the mouth. Teeth on these bones may be buried in mucus, but may be felt by stroking with a needle. See *Fig. 3*.

Pectoral fin—the "shoulder fin," located just behind the head. Corresponds to the front leg of land animals. See *Fig. 1*.

Pelvic fins—paired fins lying one on either side of the mid-line of the belly. Correspond to the hind limbs of land animals, but may be located

in front of the anal fin (abdominal), more or less below the pectoral fin (thoracic), or on the throat in front of pectoral fin (jugular). See *Fig. 1*.

Posterior— backward; toward the tail.

Preopercle— the "cheek bone" of fishes. The bone lying on the side of the head just in front of the gill cover. See *Fig. 1*.

Pyloric caeca— small, finger-like sacs attached to the intestine just behind the stomach.

Rays— soft, flexible supporting rods in the fins. See *Fig. 1*.

Snout— the distance from the forward end of the upper jaw to the anterior edge of the eye. See *Fig. 1*.

Spines— generally rather strong, stiff, sharp supporting rods in some fins, especially the dorsal and anal fins. See *Fig. 1*.

Ventral— below; toward the belly.

Vomer— a bone in the center of the roof of the mouth, separating the palatines. It may have teeth only on the anterior part (head) or also on the posterior part (shaft) or be toothless. See *Fig. 3*.

How to use the Keys

In general, begin with the "Key to the Families," page 13. Here you will see paired numbered statements (1a, 1b; 2a, 2b; etc.). If your fish agrees with the description in 1a, it is a lamprey. If it does not agree with 1a, go to 1b. If it agrees with 1b, go to the number given at the end of the statement, in this case, 2. Continue to follow the paired descriptions until at last you reach a statement that leads to a name. Thus, to identify a pike, you would go 1a (disagrees, go to 1b); 1b (agrees, go to 2); 2a (agrees, go to 3); 3a (disagrees, go to 3b); 3b (agrees, go to 4); 4a (disagrees, go to 4b); 4b (agrees, go to 5); 5a (disagrees, go to 5b); 5b (agrees, go to 10); 10a (agrees, go to 11); 11a (agrees, your fish is a pike). The key to the families may end up by referring you to a key to the species within the family group. Here you will find a similar key that will lead you to the particular kind of fish you have in hand. All the keys are used in the same way.

These keys have been designed for Alaskan fresh-water fishes only. Attempts to use them in other areas of North America, or for marine fishes in Alaska, will almost certainly lead to wrong identifications.

Key to the Families

		Description	If Description Agrees go to	Page No.
1a.		No jaws, mouth a round sucking disc. A single dorsal median nostril present.....	Lampreys, Family Petromyzontidae	21
1b.		Mouth with jaws. Nostrils paired, not median.....	2	
2a.	(1)	Pelvic fins far back, abdominal in position (see "Pelvic fins" in glossary).....	3	
2b.		Pelvic fins forward, just behind head or under head, thoracic or jugular in position.....	13	
3a.	(2)	Five rows of keeled bony shields present along body; four well-developed barbels present under snout in front of mouth.....	Sturgeons, Family Acipenseridae	25
3b.		No keeled bony shields on body, although flat shields present in one family; no barbels under snout (a single barbel present on tip of lower jaw in some).....	4	
4a.	(3)	No lateral line.....	Herrings and Shads, Family Clupeidae	27
4b.		A lateral line present.....	5	

		Description	If Description Agrees go to	Page No.
5a.	(4)	An adipose fin present.....	6	
5b.		No adipose fin.....	10	
6a.	(5)	Adipose fin well behind base of anal fin. Pectoral fin reaches past base of pelvic fins. Dorsal fin with two spines, anal fin with one spine anteriorly.....	Troutperch, Family Percopsidae	61
6b.		Adipose fin about over base of anal fin. Pectoral fin does not reach base of pelvic fins. No spines in dorsal or anal fins.....	7	
7a.	(6)	Pelvic axillary process present.....	8	
7b.		Pelvic axillary process absent.....	Smelts, Family Osmeridae	55
8a.	(7)	Dorsal fin long, 18 or more soft rays, its anterior end ahead of posterior tip of pectoral fin.....	Grayling, Subfamily Thymallinae of the Family Salmonidae	53
8b.		Dorsal fin smaller, 15 or fewer rays, its anterior end behind tip of pectoral fin.....	9	

		Description	If Description Agrees go to	Page No.
9a.	(8)	Teeth in jaws small and weak, or absent. Scales large, 4-11 rows above lateral line.....	Whitefishes, Subfamily Coregoninae of the Family Salmonidae	29
9b.		Teeth in jaws well developed. Scales small, difficult to count, 20-27 rows above lateral line.....	Salmons and Trouts, Subfamily Salmoninae of the Family Salmonidae	37
10a.	(5)	Teeth present in mouth. Front of dorsal fin nearer to base of tail than to tip of snout.....	11	
10b.		No teeth in jaws. Front of dorsal fin closer to tip of snout than to base of tail.....	12	
11a.	(10)	Caudal fin forked. Snout long, nearly $\frac{1}{2}$ of head length, flattened like a duck's bill. Pelvic fin with 10 or 11 rays.....	Pikes, Family Esocidae	59
11b.		Caudal fin rounded. Snout shorter, about $\frac{1}{3}$ length of head, not duck-billed. Pelvic fin with 0-3 rays.....	Alaska blackfish, Family Dallidae	59
12a.	(10)	Mouth a ventrally placed sucker, lips thick and covered with papillae. Distance from snout tip to anus more than $2\frac{1}{2}$ times distance from anus to base of tail.....	Suckers, Family Catostomidae	61

		Description	If Description Agrees go to	Page No.
12b.		Mouth normal, lips not covered with papillae. Distance from snout to anus about 1½ times distance from anus to base of tail.....	Minnows, Family Cyprinidae	61
13a.	(2)	Both eyes on same side of head.....	Flounders, Family Pleuronectidae	73
13b.		Eyes in normal position, one on each side of head.....	14	
14a.	(13)	Several free spines in front of dorsal fin, not connected to each other by membranes. Pelvic fin formed of a single spine.....	Sticklebacks, Family Gasterosteidae	65
14b.		No free spines in front of dorsal fin. Pelvic fin not reduced to a single spine.....	15	
15a.	(14)	First dorsal fin made up of spines connected by membrane. No barbel under chin.....	16	
15b.		No spines in any fins (only soft rays). A barbel present under chin (may be very small).....	Codfishes, Family Gadidae	63
16a.	(15)	Body covered with distinct scales. Anal fin with three spines.....	Surfperches, Family Embiotocidae	67
16b.		Body naked or partly covered with bony tubercles or prickles. No spines in anal fin.....	Sculpins, Family Cottidae	67

Legend

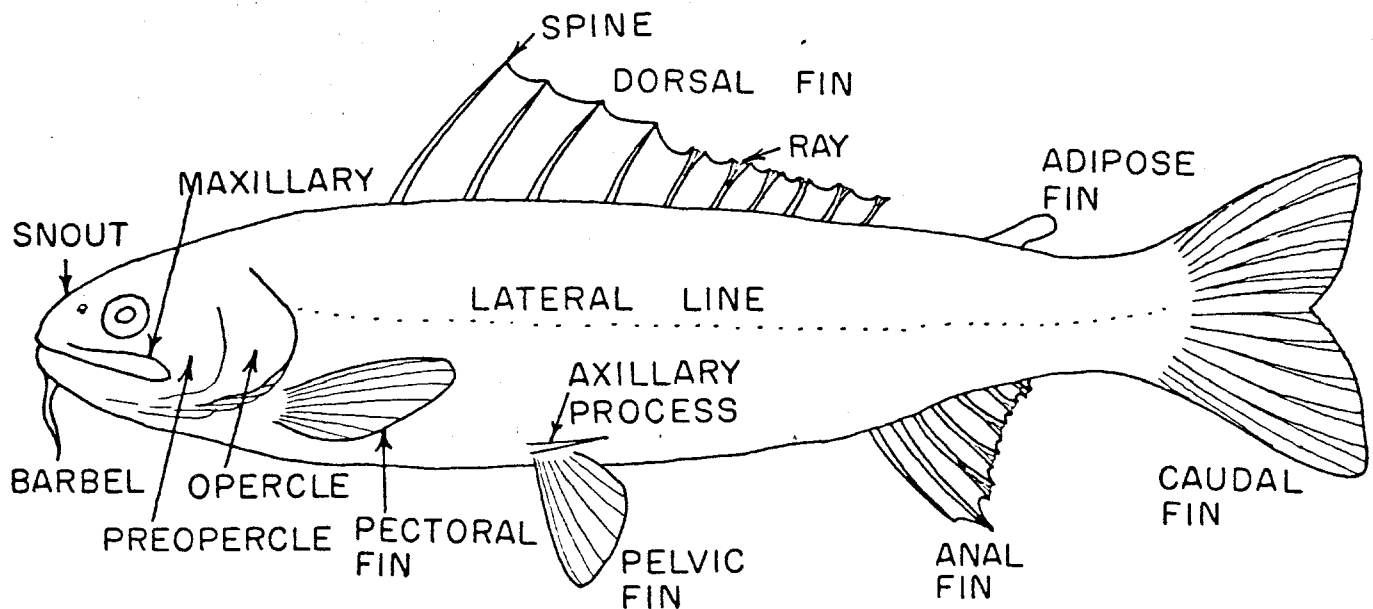


FIGURE 1. A "generalized" fish showing the various structures referred to in the keys.

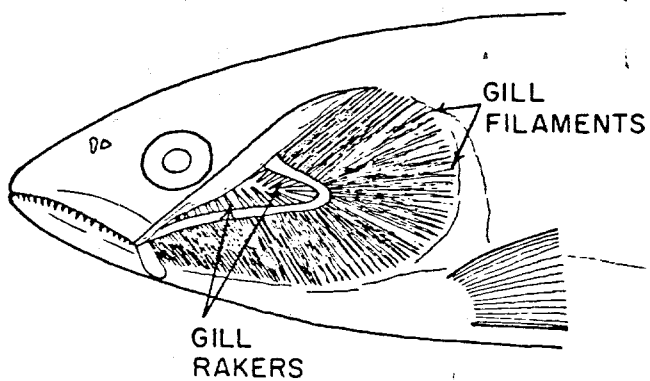


FIGURE 2. Diagram of a gill arch, showing the gill filaments and the gill rakers.

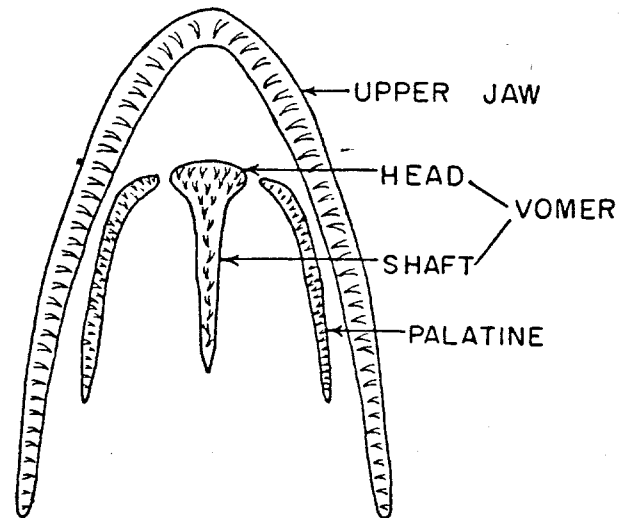


FIGURE 3. Diagram of the roof of the mouth of a fish to show the teeth on the jaws, the head and shaft of the vomer bone, and the palatines.

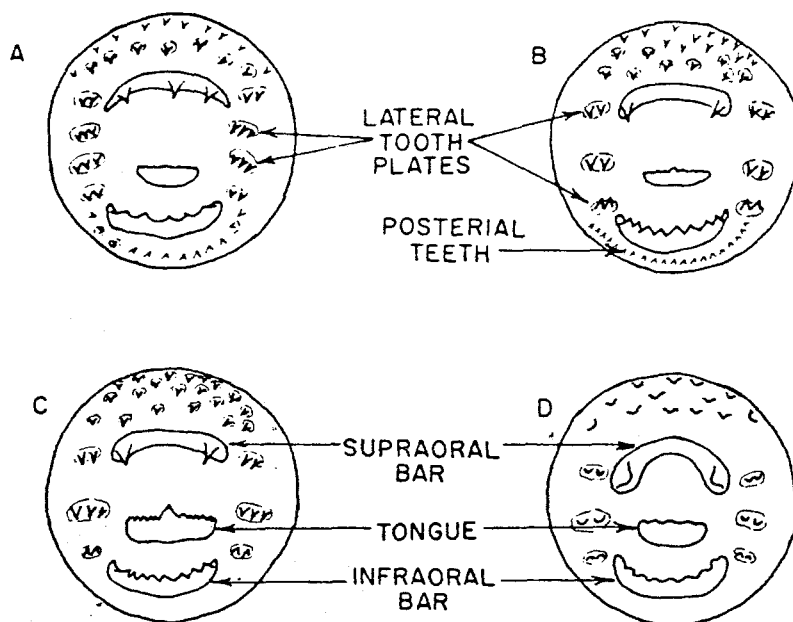


FIGURE 4. Tooth patterns of Alaska lampreys. A. Pacific lamprey, *Entosphenus tridentatus*. B. Arctic lamprey, *Lampetra japonica*. C. River lamprey, *Lampetra ayresi*. D. Western brook lamprey, *Lampetra richardsoni*.

Keys to the Species

LAMPREYS, Family Petromyzontidae

1a.

Supraoral tooth bar with 3 (rarely 2) sharp teeth; infraoral bar with about 5 teeth. Four pairs of lateral tooth plates, the 2 central pairs each with 3 points. (Fig. 4A).

Pacific lamprey

Entosphenus tridentatus (Gairdner)

Ranges along the coast as far north as the Alaskan Peninsula and the Aleutian Islands. Rare in the Bristol Bay area. Recorded also from St. Lawrence Island and south to southern California. Reaches a length of about 3 feet. Seasonally abundant during spawning runs.

1b.

Supraoral tooth bar with 2 teeth (rarely with a small central third tooth); infraoral bar with 5-10 teeth (usually 7 or 8). Three pairs of lateral tooth plates. (Fig. 4, B-D).....2

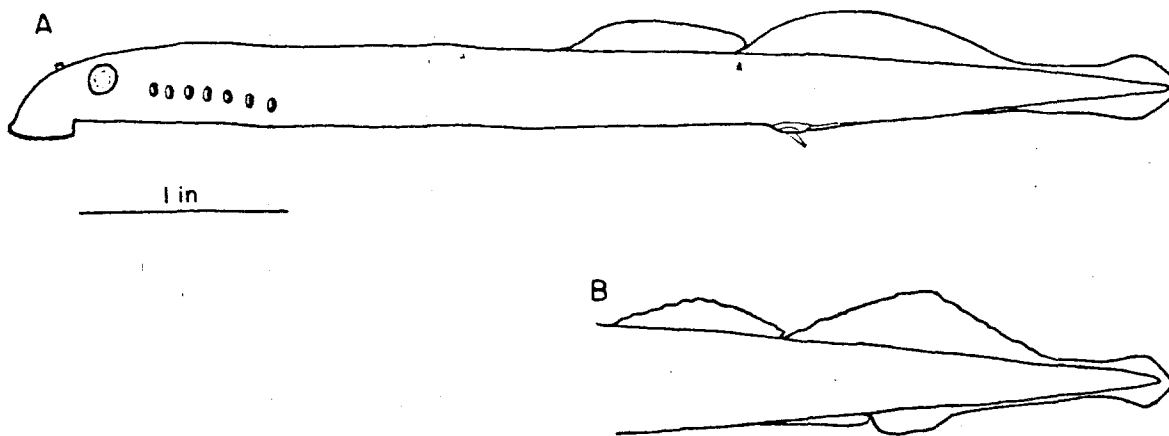


FIGURE 5. Arctic lamprey, *Lampetra japonica*. A. Male. B. Posterior end of female. Note presence of anal fin and lack of urogenital papilla in the female. All four Alaskan lampreys are much alike in general appearance, so only the one species is illustrated.

2a. (1) _____

A semicircular row of posterial teeth present below infraoral bar (may be hidden by mucus) (Fig. 4B); lateral tooth plates all with 2 points.

Arctic lamprey (Fig. 5)

Lampetra japonica (Martens)

Distributed in Alaska from the Kenai Peninsula north to the Arctic Ocean. Recorded from St. Lawrence Island, and in the Yukon drainage into Canada. Both fresh-water and anadromous populations are known. Grows to about 2 feet and ½ pound. The non-parasitic, fresh-water form reaches about 7 inches. Locally and seasonally abundant.

2b. _____

No posterial teeth. Central pair of lateral tooth plates with 2 or 3 points (Fig. 4, C, D). 3

3a. (2) _____

Teeth sharp and strong. Tongue with a large middle tooth. Three (rarely 2) points on central lateral tooth plates (Fig. 4C).

River lamprey

Lampetra ayresi (Günther)

Both fresh-water and anadromous populations are known along the coast, from the lower end of the Lynn Canal on southward. Attains length of about 12 inches. Fairly common.

3b. _____

Teeth blunt. No median tooth on tongue. Two (rarely 3) blunt points on central lateral tooth plates (Fig. 4D).

Western brook lamprey

Lampetra richardsoni Vladykov and Follett

The only Alaskan record so far is of two larvae from Lake McDonald, on the Cleveland Peninsula, near Ketchikan. Ranges south to Oregon. Maximum length about 6 inches.

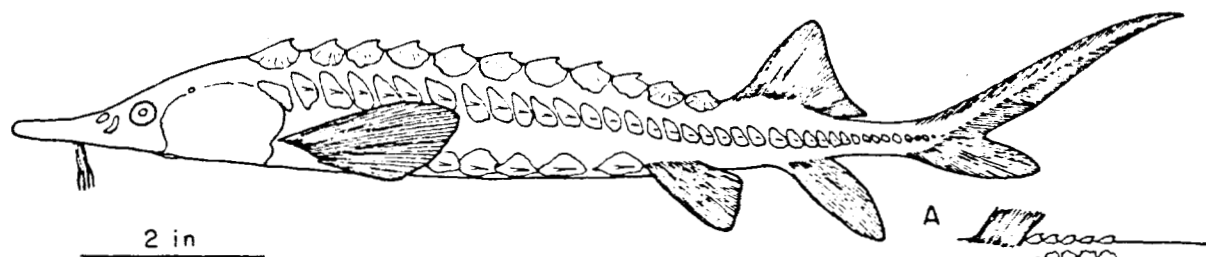


FIGURE 6. White sturgeon, *Acipenser transmontanus*. A. The two rows of bony plates in front of the anal fin.

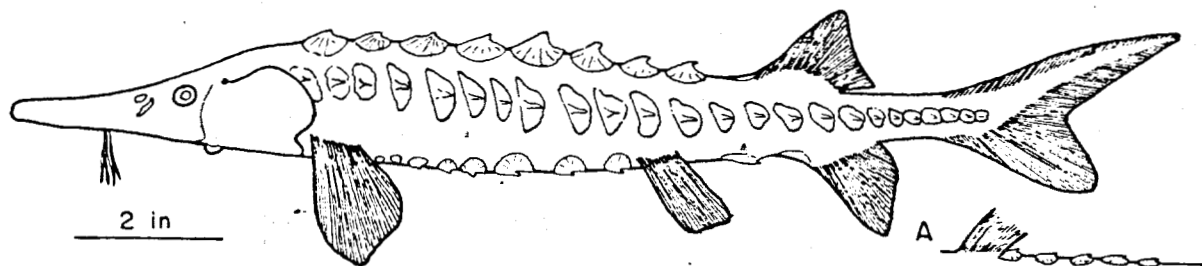


FIGURE 7. Green sturgeon, *Acipenser medirostris*. A. The single row of bony plates in front of the anal fin.

STURGEONS, Family Acipenseridae

Key to the Species

1a. _____
Bony plates between pelvic fins and anal fin in two rows of 4 to 8 plates each (Fig. 6A). Dorsal fin rays about 45.

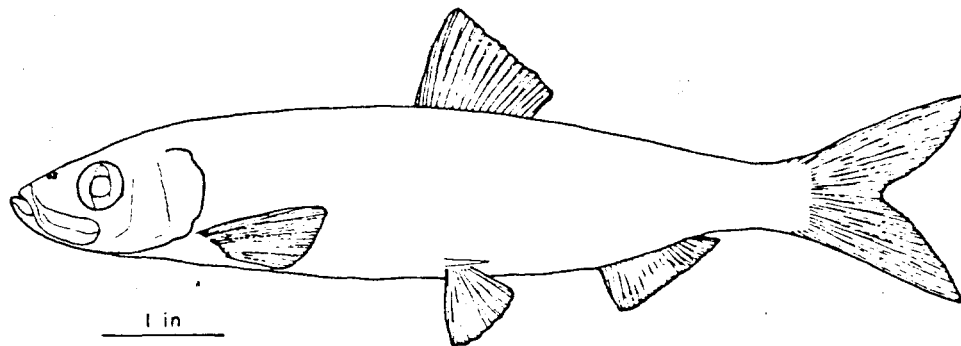
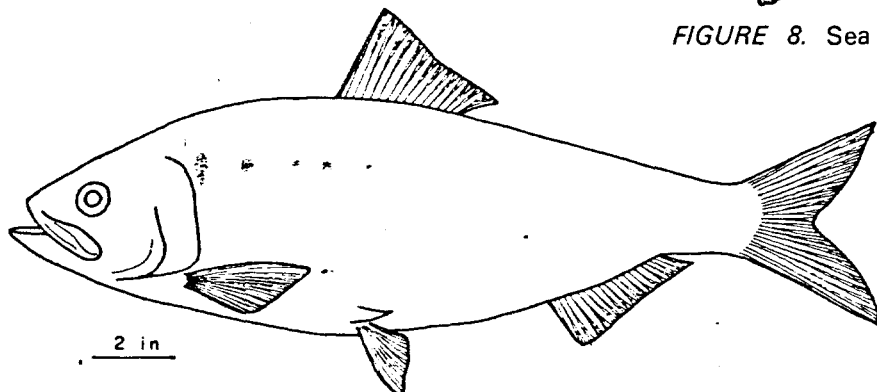
White sturgeon (Fig. 6)

Acipenser transmontanus Richardson
Found in Alaska from Southeastern to Cook Inlet, possibly also in Bristol Bay drainages. Anadromous. Ranges south to southern California. Reaches 20 feet and about 1,500 pounds. Not common in Alaska.

1b. _____
Bony plates between pelvic fins and anal fin in a single row of 1 to 4 plates (Fig. 7A). Dorsal fin rays about 33.

Green sturgeon (Fig. 7)

Acipenser medirostris Ayres
Ranges from Southeastern Alaska to the Aleutian Islands and may also be present in the Bering Sea. Westward to Asia and south to southern California. Anadromous. Length to about 7 feet, weight to 300 pounds. Not common in Alaska.

FIGURE 8. Sea herring, *Clupea harengus pallasii*.FIGURE 9. American shad, *Alosa sapidissima*.

HERRINGS AND SHADS, Family Clupeidae

Key to the Species

1a. _____
Distance from front of dorsal fin to tip of snout about equal to distance from front of dorsal fin to base of tail. Teeth present on vomer in roof of mouth (Fig. 3)

Sea herring (Fig. 8)

Clupea harengus pallasii Valenciennes
Present in the Arctic Ocean and south to California, west to Asia. A marine form that sometimes enters rivers. Achieves 15 inches in length. Seasonally abundant.

1b. _____
Distance from front of dorsal fin to tip of snout much less than distance from front of dorsal fin to base of tail. No teeth in roof of mouth.

American shad (Fig. 9)

Alosa sapidissima Wilson
Introduced into California and Oregon in the late 19th century from the east coast, the shad has spread north to Kodiak Island and Cook Inlet in Alaska and west to Asia. Anadromous. Up to 30 inches long, and 5 to 8 pounds weight. Not common in Alaska.

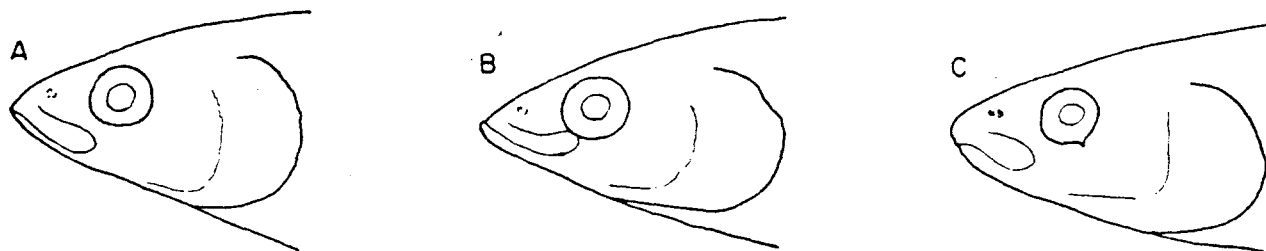


FIGURE 10. Snouts of whitefishes. A. Bering cisco, both jaws equal. B. Least cisco, tip of lower jaw projecting slightly beyond upper jaw. C. Round whitefish, lower jaw shorter than upper and profile of upper lip overhanging.

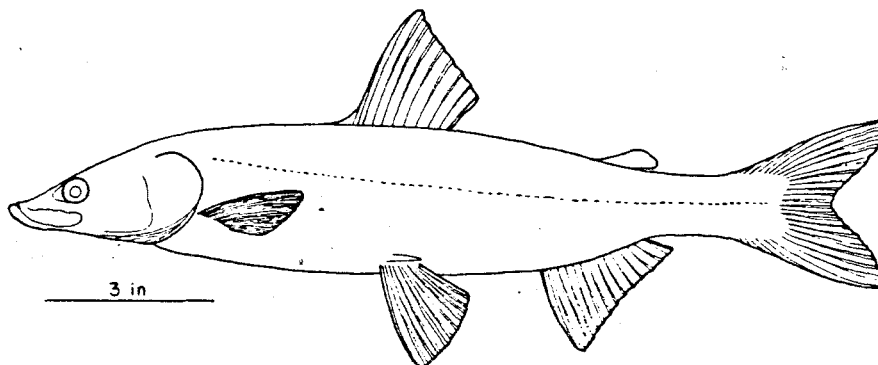


FIGURE 11. Inconnu, *Stenodus leucichthys*. Commonly called "sheefish" in Alaska.

**WHITEFISHES, Subfamily Coregoninae
of the Family Salmonidae**

Key to the Species

1a. _____
Lower jaw equal to or longer than upper jaw. Profile of upper lip not overhanging lower jaw (Fig. 10A, B).....2

1b. _____
Lower jaw distinctly shorter than upper jaw. Profile of upper lip vertical or overhanging (Fig. 10C).....5

2a. (1) _____
Mouth large, posterior end of maxillary (upper jaw) reaches below posterior margin of pupil of eye. Gill rakers 13-17 on lower limb of first arch.

Inconnu or Sheefish (Fig. 11)

Stenodus leucichthys (Güldenstadt)
Found in Alaska from the Kuskokwim River north and east to the Meade River, but absent from some of the streams in between. Quite abundant in the entire Yukon drainage. Another subspecies is in the Mackenzie drainage in Canada. May reach a weight of more than 60 pounds and a length of 5 feet. Seasonally abundant.

2b. _____
Mouth moderate, upper jaw not reaching posterior edge of pupil. More than 20 gill rakers on lower limb of first arch.....3

3a. (2) _____
Mouth superior, tip of lower jaw generally projects slightly beyond upper jaw (Fig. 10B). Pelvic fins black or dusky in adults.

Least cisco (Fig. 12)

Coregonus sardinella Valenciennes
Found from Bristol Bay to the Arctic Ocean and more or less generally throughout the Interior. Also recorded from St. Lawrence Island. Reaches a length of nearly 18 inches. Seasonally abundant.

3b. _____
Mouth terminal, tip of lower jaw not projecting beyond tip of upper jaw (Fig. 10A). Pelvic fins always pale.....4

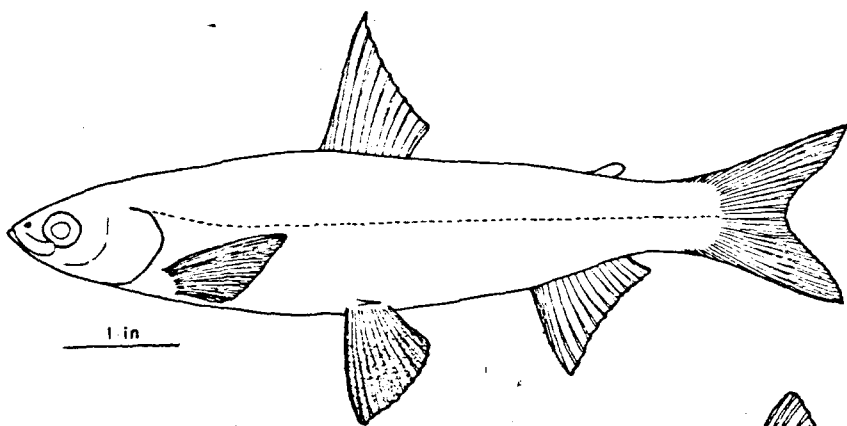


FIGURE 12. Least cisco, *Coregonus sardinella*. Note the dusky pelvic fins.

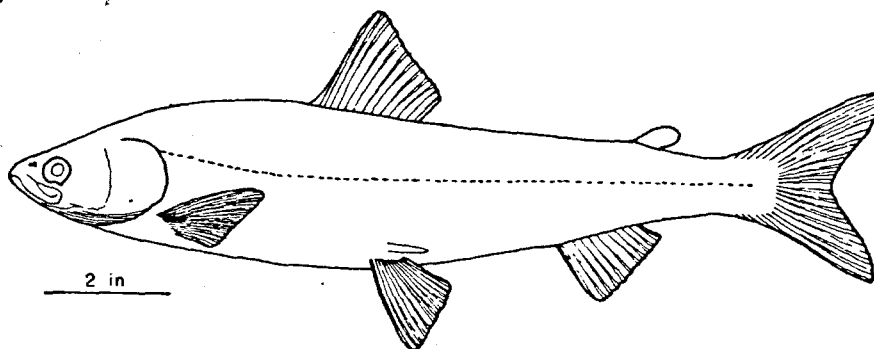


FIGURE 13. Bering cisco, *Coregonus laurettae*. Note the pale pelvic fins. The Arctic cisco, *Coregonus autumnalis*, appears identical with this species but has more gill rakers.

- 4a. (3) _____
21-25 gill rakers on lower limb of first arch.

Bering cisco (Fig. 13)

Coregonus laurettae Bean

Found from Cook Inlet north and east to the Oliktok River on the Arctic coast. Also well up the Yukon River, at least as far as Rampart, probably widely distributed in the Interior. Length to nearly 16 inches. Seasonally and locally abundant.

- 4b. _____
26-31 gill rakers on lower limb of first arch.

Arctic cisco (Fig. 13)

Coregonus autumnalis (Pallas)

Known from most of the river systems that empty into the Arctic Ocean. Apparently absent from the Bering Sea and southward. Up to about 2 feet and over 5 pounds. Seasonally abundant.

- 5a. (1) _____
Membrane around eye with a distinct notch below posterior edge of pupil (Fig. 14A). A single flap between nostrils (Fig. 14B)..... 6

- 5b. _____
Membrane around eye without a notch. A double flap between nostrils (Fig. 14C)..... 7

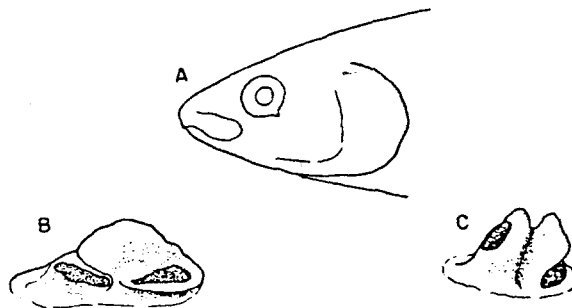


FIGURE 14.

Eyes and nasal flaps of whitefishes. A. Head of the round whitefish, showing the notch in the eye membrane. B. Nostrils of the round whitefish, with a single flap between the anterior and posterior openings. C. Nostrils of the Alaska whitefish, with a double flap between the openings. (NB — One needs a fairly strong magnifying glass to see these flaps clearly.)

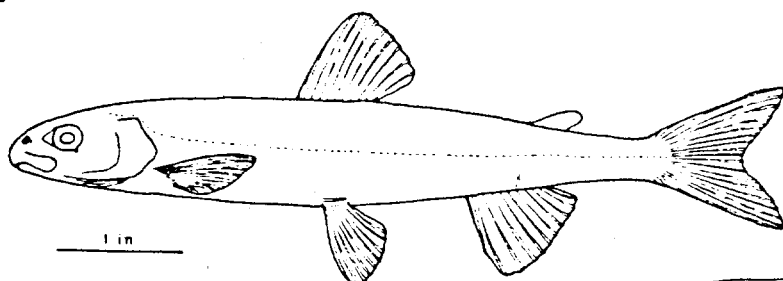


FIGURE 15. Pygmy whitefish, *Prosopium coulteri*.

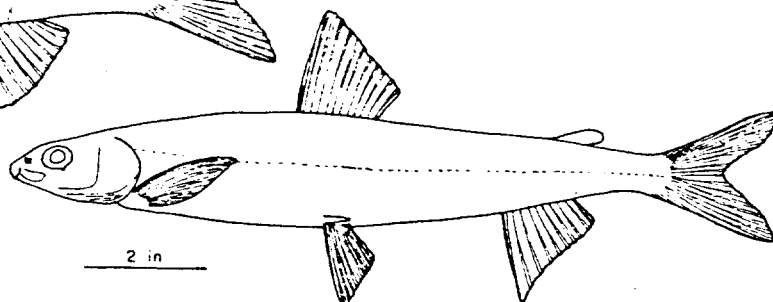


FIGURE 16. Round whitefish, *Prosopium cylindraceum*.

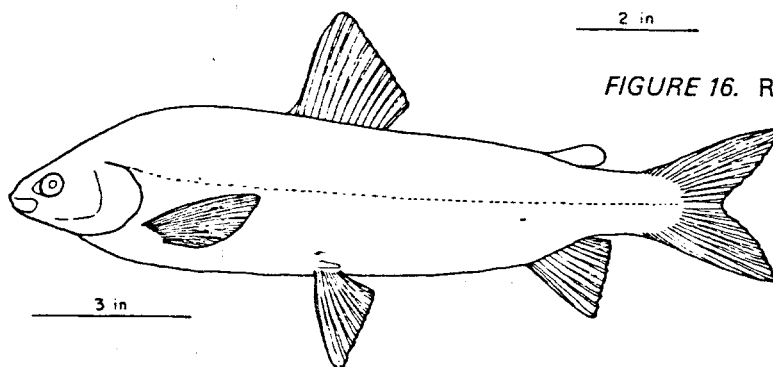


FIGURE 17. Broad whitefish, *Coregonus nasus*.

6a. (5)

Snout blunt as seen from above. Lateral line with less than 70 pored scales. 14-33 pyloric caeca.

Pygmy whitefish (Fig. 15)

Prosopium coulteri (Eigenmann and Eigenmann)

In Alaska, found in the Bristol Bay region and in Southcentral Alaska. Also present in Washington, Montana, British Columbia, Yukon Territory and in Lake Superior. Usually less than 6 inches long. Fairly abundant locally.

6b.

Snout rather pointed as seen from above. Lateral line with more than 70 pored scales. Pyloric caeca 50 or more.

Round whitefish (Fig. 16)

Prosopium cylindraceum (Pallas)

From the Taku drainage in Southeastern Alaska north to the Noatak and throughout

the Interior. The range extends east all across North America and south to the Great Lakes and New England. Westward in Siberia to the Yenisei River. Attains lengths up to 20 inches, weights to nearly 5 pounds. Seasonally and locally abundant.

7a. (5)

Gill rakers short, the longest raker less than 1/5 of interorbital width. Profile of head smoothly convex or only barely concave. Hump behind head absent, or at least not at all prominent.

Broad whitefish (Fig. 17)

Coregonus nasus (Pallas)

Found in Bering Sea drainages from the Kuskokwim River north to the Arctic Ocean. Also widely distributed in the Interior. In Siberia, west at least as far as the Pechora River. Reported to reach 35 pounds in Siberia. Largest Alaskan specimens probably less than 10 pounds. Seasonally abundant.

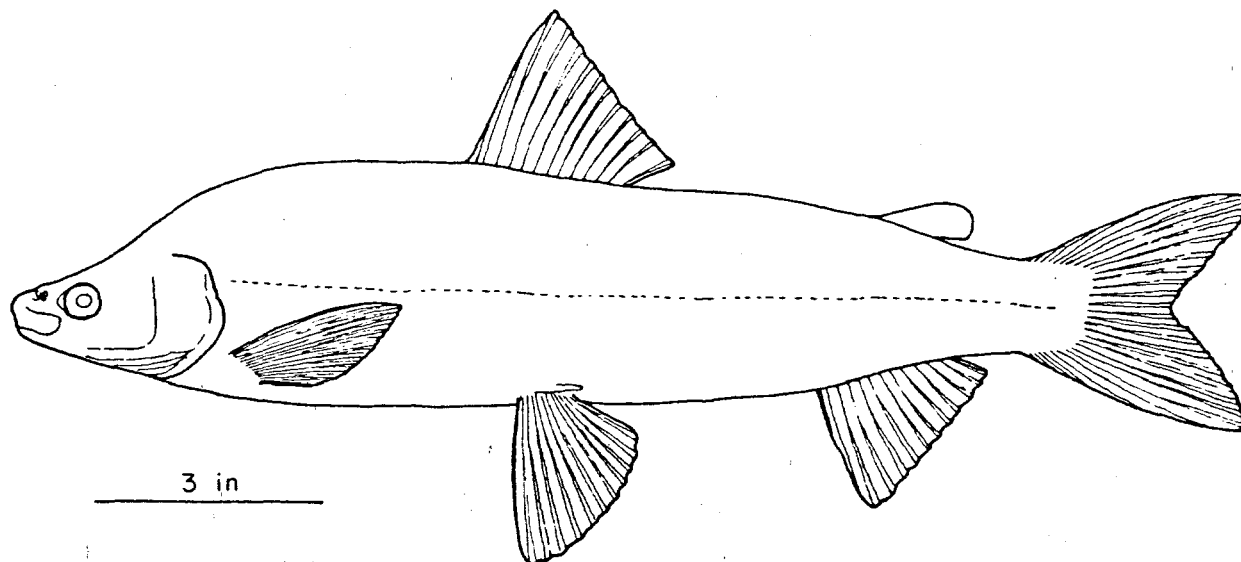


FIGURE 18. Alaska whitefish, *Coregonus nelsoni*. The Humpback and Lake whitefishes closely resemble this species but differ in number of gill rakers.

7b. _____
 Profile of head distinctly concave between snout and nape. A pronounced hump behind head in adults. Longest gill raker longer than 1/5 of interorbital width. 8

8a. (7) _____
 Total gill rakers, 19-24, average counts around 21 or 22.

Humpback whitefish (Fig. 18)

Coregonus pidschian (Gmelin)
 Bering Sea and Arctic Ocean drainages from the Kuskokwim River to the Arctic coast. Generally does not go far inland except in the Kuskokwim. A very similar fish, which may be the same species, ranges west all across Siberia. Average weight probably less than 10 pounds. Seasonally abundant.

8b. _____
 Total gill rakers 23-31 9

9a. (8) _____
 Total gill rakers 23-27, average counts around 24 or 25.

Alaska whitefish (Fig. 18)

Coregonus nelsoni Bean
 Found chiefly in the Yukon drainage, from the Bering Sea throughout the Interior. Also present in the Kobuk-Selawick area and possibly in the Wulik River. Average weight probably less than 5 pounds. Seasonally abundant.

9b. _____
 Total gill rakers, 24-31, average counts around 26 or more.

Lake whitefish (Fig. 18)

Coregonus clupeaformis (Mitchill)
 Alaskan records to date are confined to a few locations in the upper Yukon drainage. Ranges eastward across Canada, south to the Great Lakes and the Susquehanna River. Largest specimen known was one of 42 pounds taken in Lake Superior in 1918.

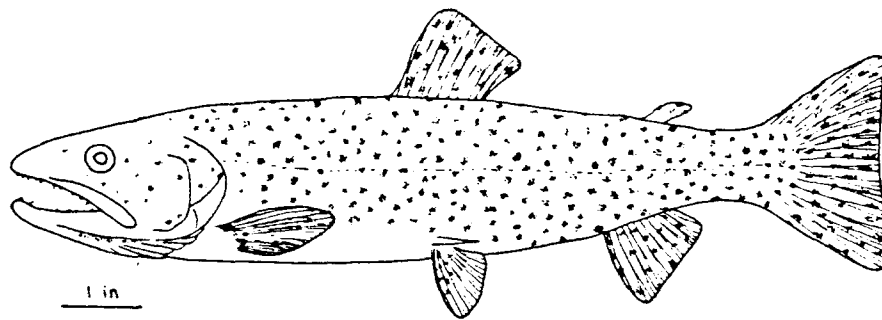


FIGURE 19. Cutthroat trout, *Salmo clarki*. In Alaska, most fresh-water populations are heavily spotted, as shown, but in more southerly populations the spots are generally not so numerous. Spots are missing on freshly sea-run cutthroats.

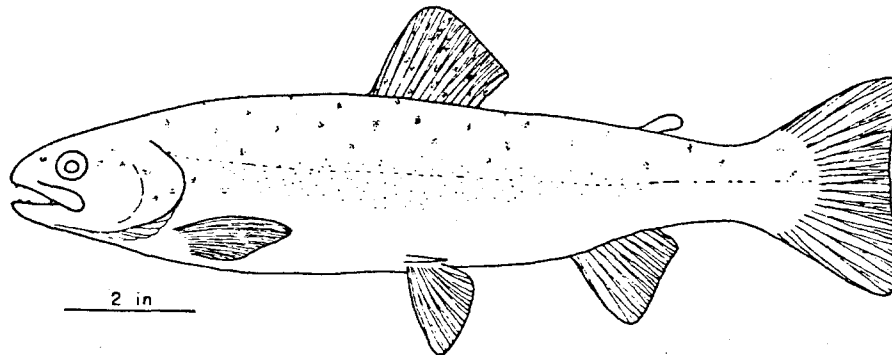


FIGURE 20. Rainbow trout, *Salmo gairdneri*.

**SALMONS AND TROUTS, Subfamily
Salmoninae of the Family Salmonidae.**

Key to the Species (Adults only)

1a. _____
Anal rays 8-12 2

1b. _____
Anal rays 13-19 (rarely 12) 8

2a. (1) _____
Teeth present on both head and shaft of vomer bone
in roof of mouth (Fig. 3). Spots on body dark brown
or black 3

2b. _____
Teeth on head of vomer, none on shaft. Spots on
body pale or red, never brown or black 4

3a. (2) _____
Small teeth present on floor of mouth behind tongue
(hard to see). A red slash under lower jaw (usually
pale in sea-run fish and missing in some fresh-water
populations). No red band on sides. Upper jaw
reaches well behind eye in adults.

Cutthroat trout (Fig. 19)

Salmo clarki Richardson
Southeastern Alaska, north to Prince
William Sound. Other subspecies range
southward as far as Nevada. The record
weight is 41 pounds, but most weigh 1 to 4
pounds. Locally abundant.

3b. _____
No teeth on floor of mouth behind tongue. Generally
no red slash under jaws (present in some Bristol Bay
populations). A reddish band on sides, most
prominent in spawning males but absent on freshly
sea-run individuals. Upper jaw reaches little, if any,
behind eye in adults.

Rainbow trout (Fig. 20)

Salmo gairdneri Richardson
Ranges from Southeastern Alaska north to
the drainages of Bristol Bay. Has been
introduced into a number of lakes in the

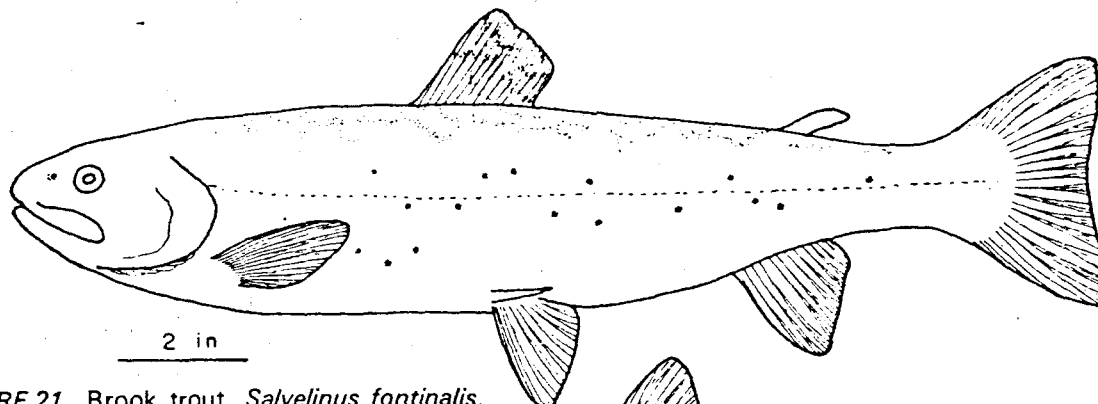


FIGURE 21. Brook trout, *Salvelinus fontinalis*.

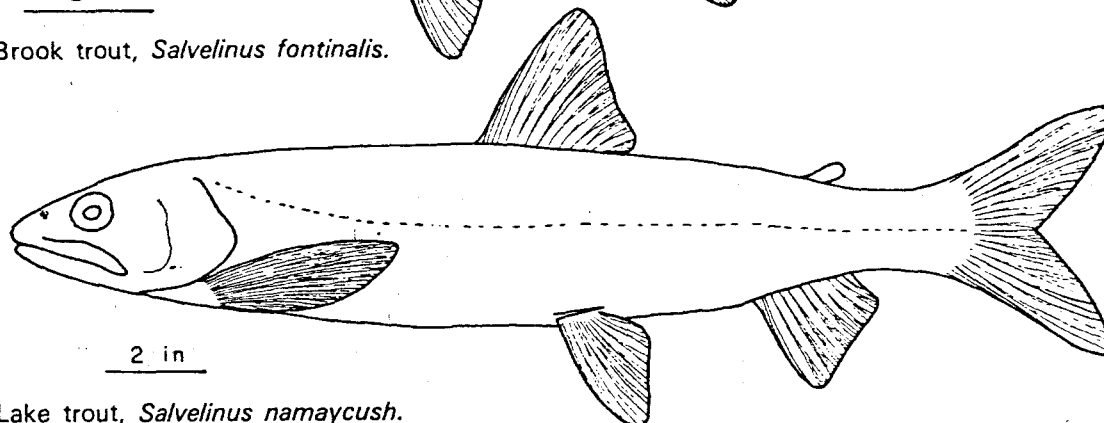


FIGURE 22. Lake trout, *Salvelinus namaycush*.

Interior. Widespread, either naturally or by introduction, in the rest of the U.S. and much of Canada. Largest on record weighed 52.5 pounds. Locally abundant.

4a. (2) _____

Dark green wavy marks on back and dorsal fin.

Brook trout (Fig. 21)

Salvelinus fontinalis (Mitchill)

An eastern species that was introduced into Southeastern Alaska some years ago. Up to 3 feet and 15 pounds, but usually less than 12 inches. Rare in Alaska.

4b. _____

No dark green marbling on back or dorsal fin. 5

5a. (4) _____

Caudal fin deeply forked. Body color dark green to grayish, with numerous oval or irregular whitish to yellow spots on sides and back. Pyloric caeca 90-200.

Lake trout (Fig. 22)

Salvelinus namaycush (Walbaum)

Found in most suitable lakes from the Alaska Peninsula northward. Present in the Copper River drainage, Kobuk River, Noatak River and in many lakes of the Interior and arctic parts of the state. Absent from the lower Yukon drainage. Ranges all across Canada, south to the Great Lakes region and northern New England. Up to 4 feet and 102 pounds, but usually much smaller. Locally abundant.

5b. _____

Caudal fin only slightly forked. Spots on body round, may be red, pink or yellow in life. Pyloric caeca 13-74. 6

6a. (5) _____

Pyloric caeca 13-35. Stream spawners. 7

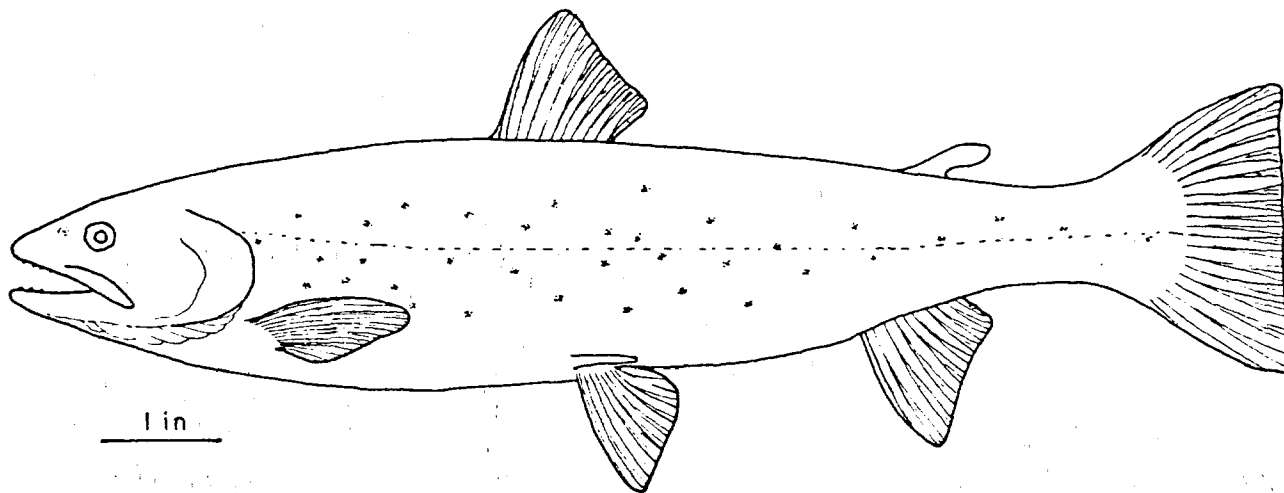


FIGURE 23. Dolly Varden, *Salvelinus malma*. The Arctic charr and Angayukaksurak charr look very much like the Dolly Varden, but the Angayukaksurak charr is black and the Arctic charr has more gill rakers and pyloric caeca.

6b.

Pyloric caeca 30-74. Lake spawners.

Arctic charr (Fig. 23)

Salvelinus alpinus (Linnaeus)

Found from Kodiak and the Aleutians to the Arctic coast and at scattered locations in the Interior, such as Wonder Lake in Mount McKinley National Park. Its general distribution is circumpolar, including the British Isles, Iceland, Europe, northern USSR. Size up to about 3 feet and 26 pounds, usually much smaller. Locally and often seasonally abundant.

7a. (6)

Body black with fiery red spots. Pelvic fin rays usually 10.

Angayukaksurak charr (Fig. 23)

Salvelinus anaktuvukensis Morrow

Confined to headwaters situations high in the Brooks Range, from Howard Pass to the Aichilik River. This is a very rare species. Maximum length probably less than 1 foot.

7b.

Body not black. Pelvic fin rays usually 9.

Dolly Varden (Fig. 23)

Salvelinus malma (Walbaum)

Ranges from Southeastern Alaska to the Arctic coast and in scattered locations in the Interior. The Aleutian Islands mark the boundary between a northern and a southern subspecies. Both anadromous and strictly fresh-water populations are known. Ranges eastward to the Mackenzie system, south to Nevada. The same or a very similar form is also found in northeastern Siberia. Reported to reach a length of over 3 feet and a weight of 40 pounds. Locally and seasonally abundant.

8a. (1)

Distinct black spots present on back and tail. 9

8b.

No distinct black spots on back or tail, although fine speckling may be present. 12

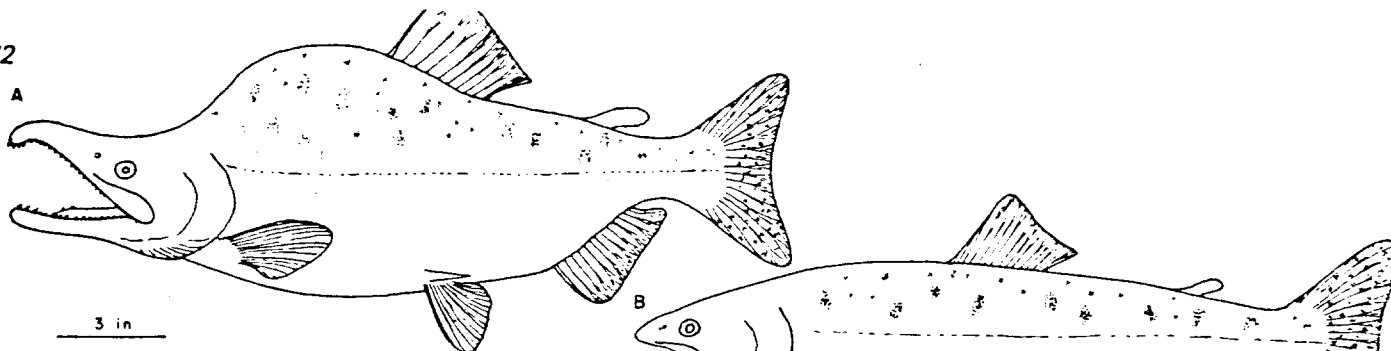


FIGURE 24. Pink salmon, *Oncorhynchus gorbuscha*.
A. Breeding male. B. Mature female.

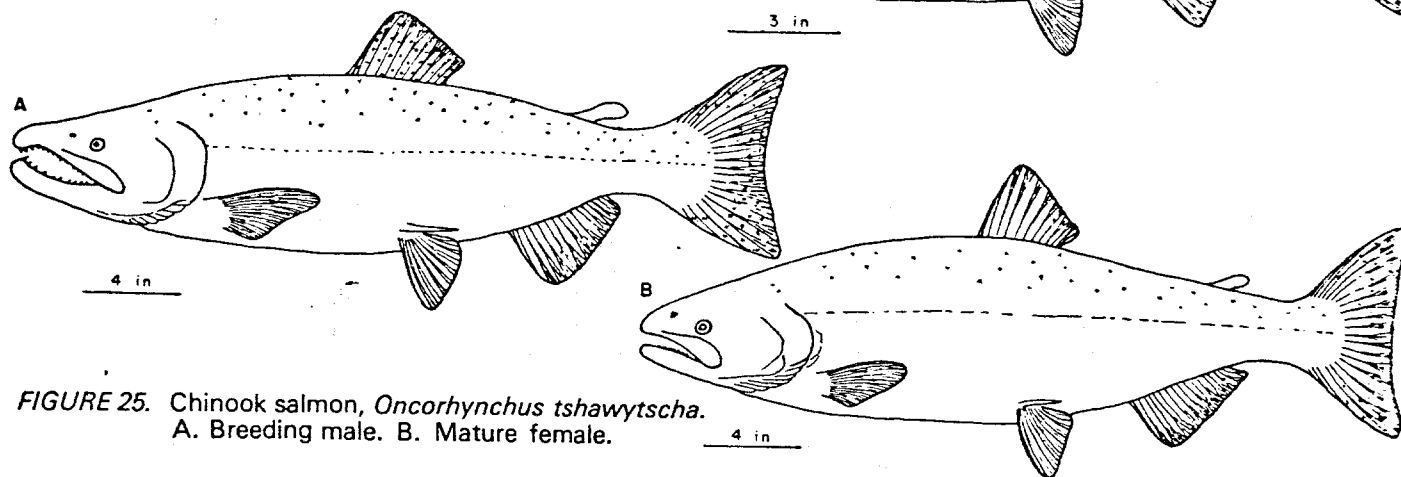


FIGURE 25. Chinook salmon, *Oncorhynchus tshawytscha*.
A. Breeding male. B. Mature female.

9a. (8) _____

Spots large, more or less oval, longest as long as diameter of eye. Scales small, 170 or more in first row above lateral line.

Pink salmon (Fig. 24)

Oncorhynchus gorbuscha (Walbaum)

Found from Southeastern to the Arctic in coastal streams. Anadromous. Ranges south to the Sacramento River in California, east to the Mackenzie, west to the Lena River in Siberia. Up to 30 inches and about 14 pounds. Locally and seasonally abundant.

9b. _____

Spots small and irregular, the largest smaller than eye diameter. Scales larger, 155 or less in first row above lateral line. 10

10a. (9) _____

Gill rakers 30-40.

Sockeye salmon—See page 45.

10b. _____

Gill rakers less than 25. 11

11a. (10) _____

Tail fin with small black spots on both upper and lower lobes. Gum line of lower jaw black. Anal rays 15-17, pyloric caeca 140-185.

Chinook salmon (Fig. 25)

Oncorhynchus tshawytscha (Walbaum)

Ranges in Alaska from Southeastern north to Point Hope. Present in most rivers of the Interior. Anadromous. Found also as far south as the Ventura River, California, and as far west as the Anadyr River in Siberia. Heaviest official record is 126 pounds. Another reported at 135 pounds. Seasonally abundant.

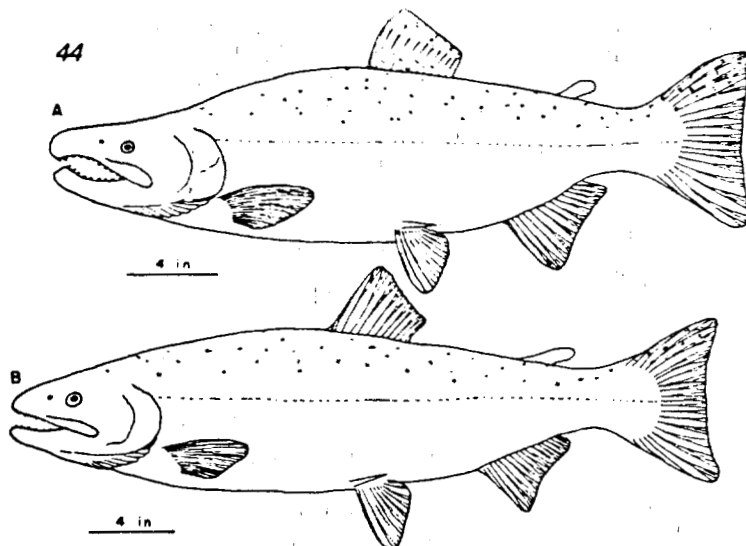


FIGURE 26. Coho salmon, *Oncorhynchus kisutch*. A. Breeding male. B. Mature female.

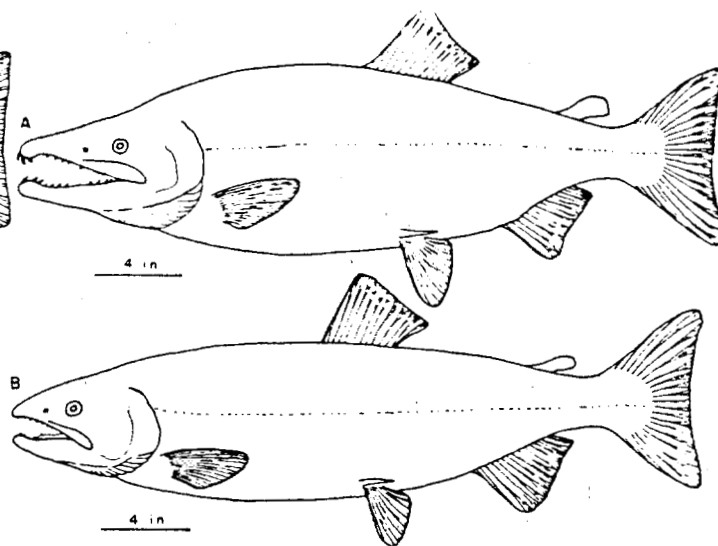


FIGURE 27. Chum salmon, *Oncorhynchus keta*. A. Breeding male. B. Mature female.

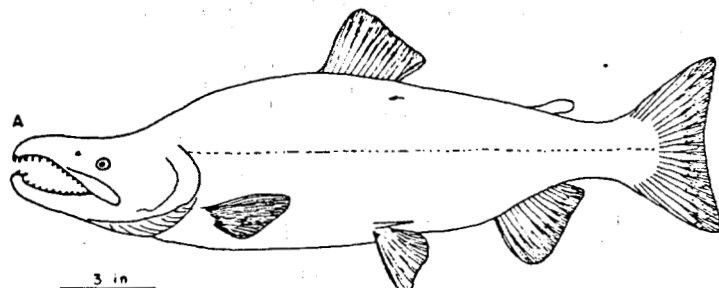


FIGURE 28. Sockeye salmon, *Oncorhynchus nerka*. A. Breeding male. B. Mature female.

11b.

Tail fin either without spots or spotted only on the upper lobe. Anal rays 13-15. Gum line of lower jaw not black.

Coho salmon (Fig. 26)

Oncorhynchus kisutch (Walbaum)
Found in coastal streams from Southeastern Alaska north to Point Hope, but rare north of Norton Sound. Also goes well inland in the Yukon and Kuskokwim drainages. Anadromous. Ranges south to Monterey Bay, California, and west as far as the Anadyr River in Siberia. May reach nearly 40 inches and 31 pounds, usually about 10 pounds. Seasonally abundant.

12a. (8)

Gill rakers 18-28, short, stout, smooth and widely spaced. Pyloric caeca 163-249.

Chum salmon (Fig. 27)

Oncorhynchus keta (Walbaum)
Ranges in Alaska from Southeastern to the Arctic coast and throughout the Interior. Anadromous. Also found eastward to the

Mackenzie and south to the Sacramento River in North America, and in Asia from Korea north and west to the Lena River in Siberia. May attain over 3 feet and 33 pounds. Seasonally abundant.

12b.

Gill rakers 30-40, long, fine, serrated and closely spaced. Pyloric caeca 45-115.

Sockeye salmon (Fig. 28)

Oncorhynchus nerka (Walbaum)
This species appears twice in the key because some populations are spotted (cf 8a and 8b), especially in the young. Ranges in Alaska from Southeastern north to Point Hope, but the most northerly major population is on the Seward Peninsula. Found inland in the Yukon as far upstream as the mouth of the Koyukuk, and in the Kuskokwim River. Anadromous. Its total distribution extends south to the Klamath River, California, and west to the Anadyr River in Siberia. Also present in the headwaters of the Peace River in Canada. Reaches a length of nearly 3 feet and weight of 15 pounds. Locally and seasonally abundant.

FIGURE 29. Brook trout 3½ inches long.

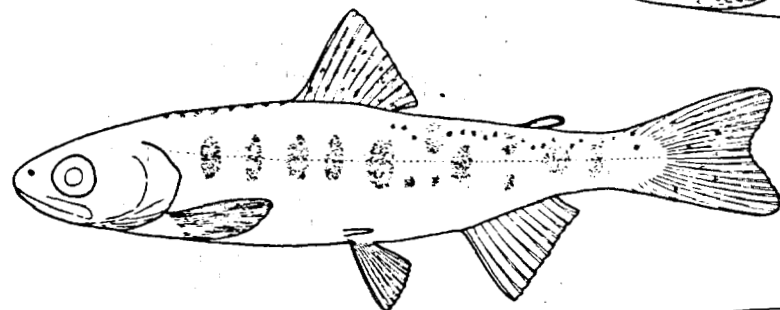
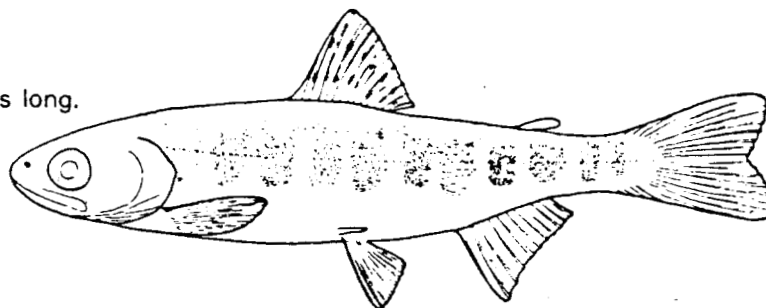


FIGURE 30. Rainbow trout 3½ inches long.

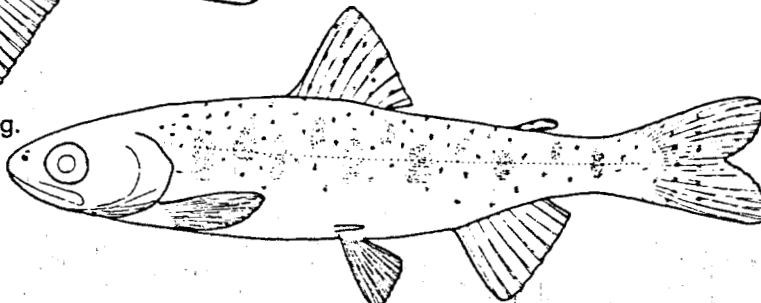


FIGURE 31. Cutthroat trout 3½ inches long.

ALASKA DEPT. OF
FISH & GAME 47

SEP 21 1975

**Key to young salmon and trout less than
about 5 inches long**

HABITAT

REGIONAL OFFICE

1a. _____
Anal rays 8-12..... 2

1b. _____
Anal rays 13 or more (rarely 12)..... 6

2a. (1) _____
Dorsal fin with distinct dark spots, or first dorsal ray
is black..... 3

2b. _____
Dorsal fin without dark spots, first ray not black (lake
trout may have faint dark bars)..... 5

3a. (2) _____
Red or yellow spots present along lateral line.
Combined width of dark parr marks along lateral line
equal to or greater than combined width of light
areas between.

Brook trout (Fig. 29)

Salvelinus fontinalis (Mitchill)

3b. _____
No red or yellow spots along lateral line. Width of
dark parr marks along lateral line less than width of
light areas..... 4

4a. (3) _____
Usually 5 to 10 dark marks along middle of back in
front of dorsal fin. Black border of adipose fin with
only one break or unbroken.

Rainbow trout (Fig. 30)

Salmo gairdneri Richardson

4b. _____
No more than 5 (usually 4 or less) dark marks along
back in front of dorsal fin. Black border of adipose fin
usually with one or more breaks.

Cutthroat trout (Fig. 31)

Salmo clarki Richardson

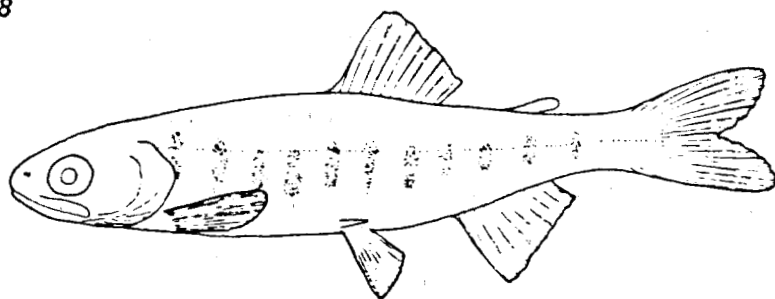


FIGURE 32. Lake trout 5 inches long.

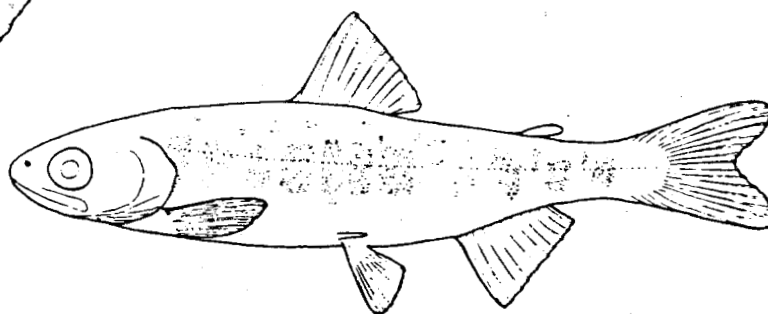


FIGURE 33. Dolly Varden 4 inches long.

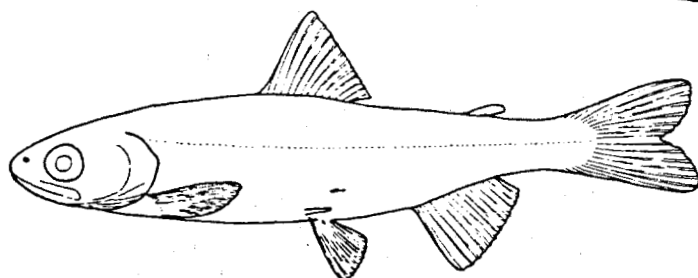


FIGURE 34. Pink salmon 2 inches long.

5a. (2) _____

Parr marks in form of vertical bars. Width of light areas usually equal to or greater than width of dark areas. Distance from snout to front of dorsal fin about one-half distance from snout to base of tail.

Lake trout (Fig. 32)

Salvelinus namaycush (Walbaum)

5b. _____

Parr marks are irregular blotches. Width of dark areas greater than width of light areas. Distance from snout to front of dorsal fin less than one-half distance from snout to base of tail.

Dolly Varden and Arctic charr (Fig. 33)

Salvelinus malma (Walbaum) and *Salvelinus alpinus* (Linnaeus)

6a. (1) _____

No parr marks. Maximum size in fresh water about 2 inches.

Pink salmon (Fig. 34)

Oncorhynchus gorbuscha (Walbaum)

6b. _____

Parr marks present. Maximum size in fresh water up to 5 inches or more. 7

7a. (6) _____

Parr marks short, elliptical or oval, not much longer than vertical diameter of eye, reaching little, if any, below lateral line. 8

7b. _____

Parr marks tall vertical bars, almost bisected by lateral line, highest parr mark much longer than vertical eye diameter. 9

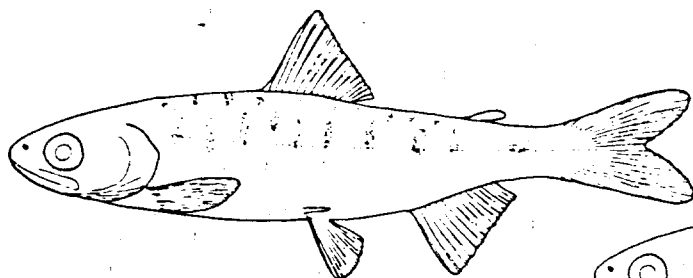


FIGURE 35. Sockeye salmon 3 3/4 inches long.

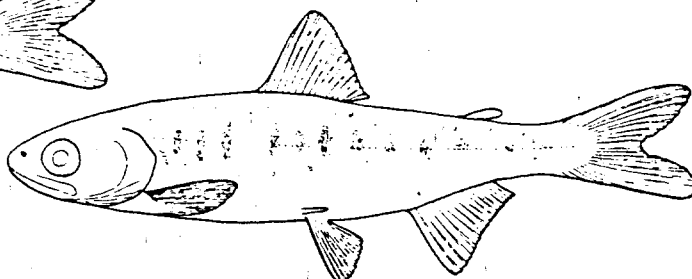


FIGURE 36. Chum salmon 4 inches long.

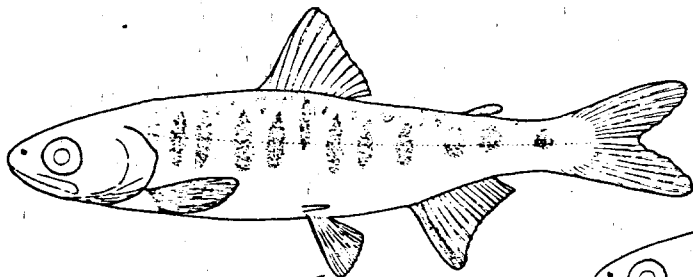


FIGURE 37. Coho salmon 4 inches long.

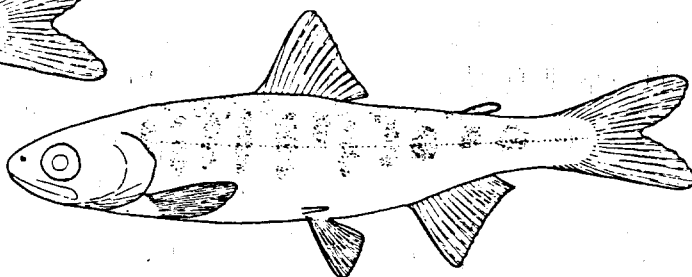


FIGURE 38. Chinook salmon 5 inches long.

8a. (7) _____

Gill rakers about 11+18. A row of definite black spots on back.

Sockeye salmon (Fig. 35)

Oncorhynchus nerka (Walbaum)

8b. _____

Gill rakers about 10+14. Black spots on back, if present, irregular in position.

Chum salmon (Fig. 36)

Oncorhynchus keta (Walbaum)

9a. (7) _____

First anal ray elongate, producing a concave outer margin to anal fin. Usually some pigment behind white leading edge of anal fin. Adipose fin uniformly dark.

Coho salmon (Fig. 37)

Oncorhynchus kisutch (Walbaum)

9b. _____

First anal ray not elongate. Anal fin usually without dark pigment behind leading edge. Adipose fin pigmented only around edges.

Chinook salmon (Fig. 38)

Oncorhynchus tshawytscha (Walbaum)

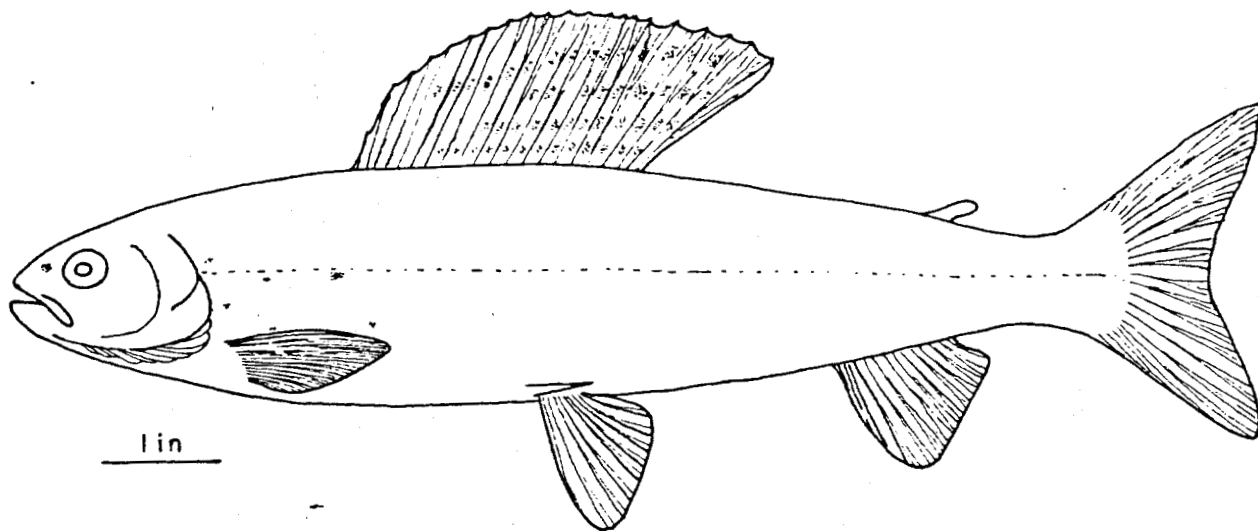


FIGURE 39. Arctic grayling, *Thymallus arcticus*.

**GRAYLING, Subfamily Thymallinae
of the Family Salmonidae**

Key to the Species

Thymallus arcticus (Pallas)

Only one species, the Arctic grayling, (Fig. 39), is found in Alaska. Ranges through the northern part of the state from the north side of the Chugach Mountains to the Arctic coast. Known also from the Susitna and Copper rivers and Saint Lawrence Island. Ranges eastward across Canada to the west coast of Hudson's Bay, south to Montana. Widely distributed in Asia as far west as the Ob River and south to Mongolia. Known to reach a weight of 5 pounds, but most are much smaller. Abundant.

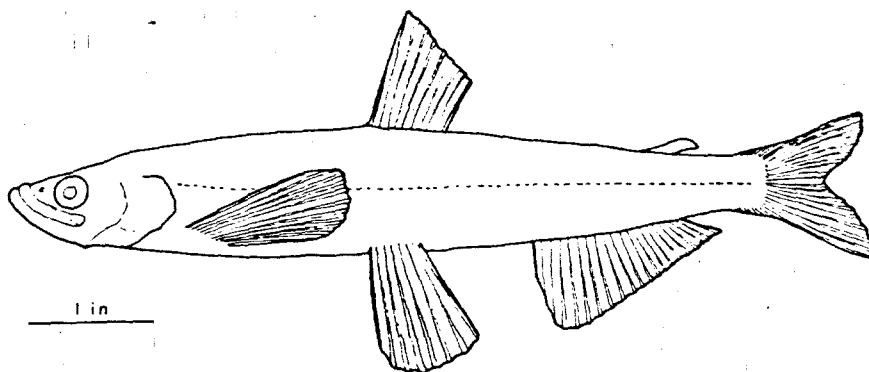


FIGURE 40. Longfin smelt, *Spirinchus thaleichthys*.

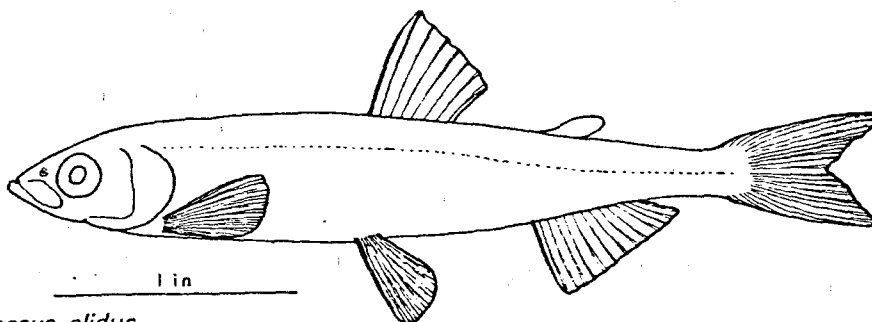


FIGURE 41. Pond smelt, *Hypomesus olidus*.

SMELTS, Family Osmeridae

Key to the Species

1a. _____
Teeth on vomer bone in roof of mouth, (see Fig. 3), small and numerous, not like canine teeth..... 2

1b. _____
One or more large canine teeth on each wing of vomer (may be missing in spawning adults of the Eulachon)..... 4

2a. (1) _____
Mouth small, upper jaw not reaching behind middle of pupil of eye. Teeth in roof of mouth in two rows on both vomer and palatines..... 3

2b. _____
Mouth large, upper jaw reaching at least to middle of pupil of eye. Teeth in single row on vomer and palatines.

Longfin smelt (Fig. 40)

Spirinchus thaleichthys (Ayres)
Found along the coast from Southeastern north to the Nushagak River in the Bristol Bay area. Anadromous. The range extends south to San Francisco Bay. Length to 6 inches. Locally and seasonally abundant.

3a. (2) _____
Pelvic fin bases before or under anterior end of dorsal fin. Lateral line scales 54-62.

Pond smelt (Fig. 41)

Hypomesus olidus (Pallas)
Found in Alaska in the Copper River and in Bering Sea drainages as far north as the Kobuk River. Also present in the Mackenzie River in Canada, and in Asia from northern Hokkaido westward to the Alazeya River in Siberia. Usually up to about 6 inches long. May be abundant locally and seasonally.

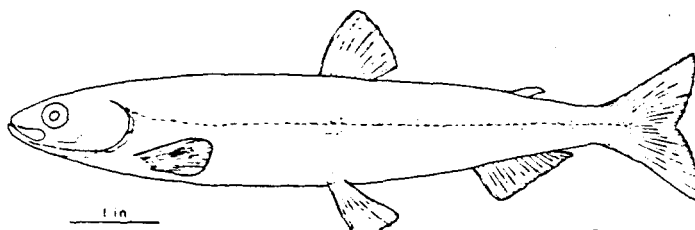


FIGURE 42. Surf smelt, *Hypomesus pretiosus*.

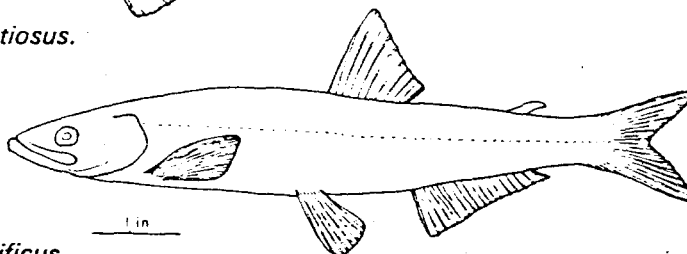


FIGURE 43. Eulachon, *Thaleichthys pacificus*.

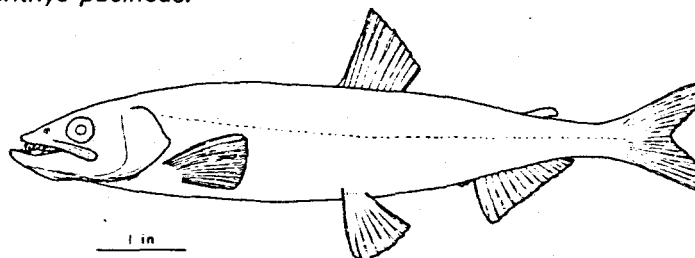


FIGURE 44. Rainbow smelt, *Osmerus mordax*.

3b. _____

Pelvic fin bases behind anterior end of dorsal fin. Lateral line scales 66-76.

Surf smelt (Fig. 42)

Hypomesus pretiosus (Girard)

Found in the sea, sometimes entering fresh water, from Yakutat south. Range extends southward to Long Beach, California. Up to nearly a foot long. Seasonally abundant.

4a. (1) _____

Anal rays 18-23. Front of dorsal fin behind a vertical through front of pelvic fin base.

Eulachon (Fig. 43)

Thaleichthys pacificus (Richardson)

An anadromous fish found in Alaska from Southeastern to Bristol Bay. The range extends south along the coast to Bodega Head in California. Reaches a length of about 12 inches. Seasonally abundant.

4b. _____

Anal rays 11-16. Front of dorsal fin on or ahead of a vertical through pelvic fin base.

Rainbow smelt (Fig. 44)

Osmerus mordax (Mitchill)

Coastal regions of Alaska from the southeastern part of the state north to the Arctic coast. Present also on Saint Lawrence Island. Anadromous. The range in North America extends south to Vancouver Island. Westward in Asia to the White Sea. May reach a foot in length. Seasonally abundant.

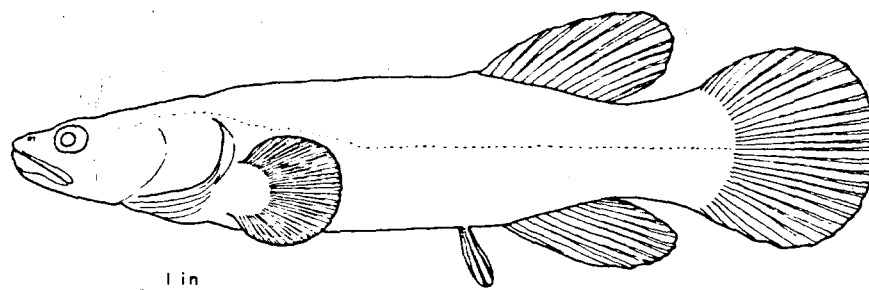


FIGURE 45. Alaska blackfish, *Dallia pectoralis*.

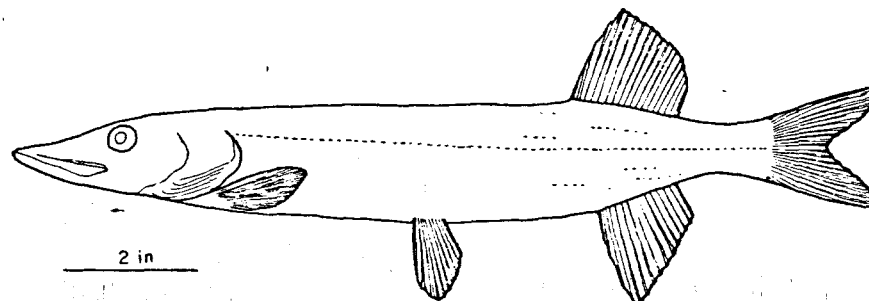


FIGURE 46. Northern pike, *Esox lucius*.

ALASKA BLACKFISH, Family Dalliidæ

Dallia pectoralis Bean

There is only one species in this family, the Alaska blackfish, *Dallia pectoralis* Bean (Fig. 45). It ranges from the Alaska Peninsula north to the Arctic coast, mainly in coastal areas. Found also in the Kuskokwim River, on Saint Lawrence, Saint Matthew and Nunivak Islands, and in the Yukon drainage as far upstream as Fairbanks. Introduced into Hood Lake, Anchorage, and to Saint Paul Island in the Pribilofs. Ranges westward to the Chukhotsk Peninsula in Siberia. Attains a length of 8 to 10 inches in some areas. Locally abundant.

PIKES, Family Esocidae

Esox lucius Linnaeus

Only the Northern pike, *Esox lucius* Linnaeus, (Fig. 46), of this family is found in Alaska. Within the state, it ranges from the Alaska Peninsula streams that drain into Bristol Bay northward to the Arctic coast and throughout the Interior. An isolated population is in the Ahnrklin River and some ponds near Yakutat. The overall range of the species is circumpolar. Reaches at least 4 feet and 50 pounds. Abundant.

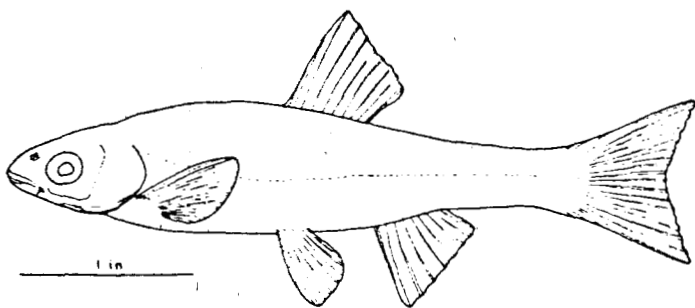


FIGURE 47. Lake chub, *Couesius plumbeus*.

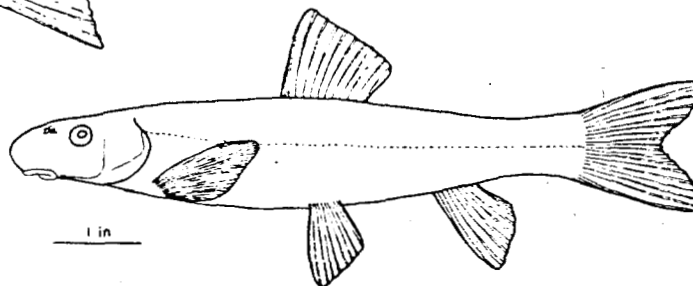


FIGURE 48. Longnose sucker, *Catostomus catostomus*.

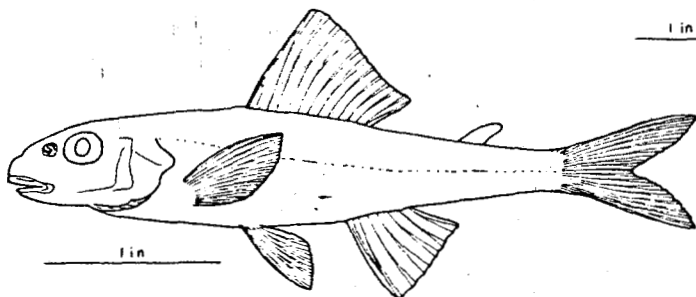


FIGURE 49. Troutperch, *Percopsis omiscomaycus*.

MINNOWS, Family Cyprinidae

Couesius plumbeus (Agassiz)

Although this is one of the largest families of fishes, only one species, the Lake chub, *Couesius plumbeus* (Agassiz), (Fig. 47), occurs in Alaska. It is found only in the Yukon River and its tributaries, as far

downstream as Nulato. Ranges eastward across Canada to Nova Scotia, south to New England and the Great Lakes in the east, to the upper Fraser and Columbia rivers in the west. Up to 6 inches long, but usually less than 4 inches. Abundant.

SUCKERS, Family Catostomidae

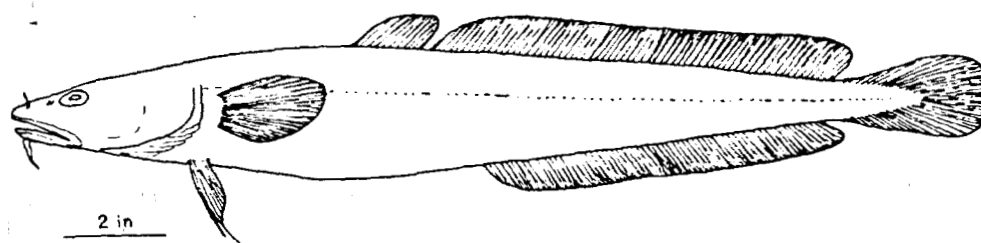
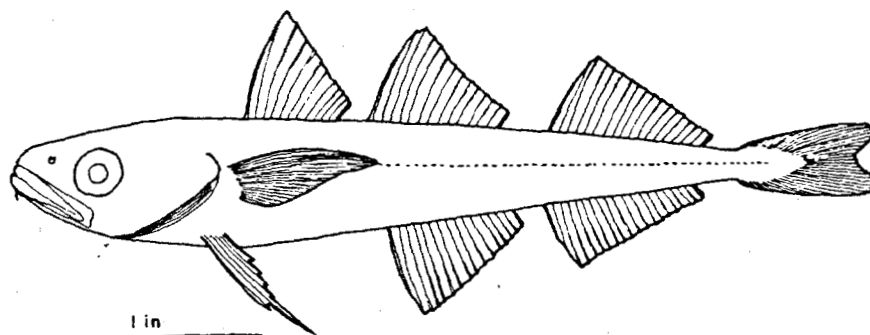
Catostomus catostomus (Forster)

Only one species, the Longnose sucker, *Catostomus catostomus* (Forster), (Fig. 48), is found in Alaska, where it occurs throughout the state in drainages emptying into the Arctic Ocean or the Bering Sea. Its entire range extends from the Yana River in Siberia east to the Atlantic coast of North America, south to Maryland. Reaches 2 feet and about 6 pounds. Abundant.

TROUTPERCHES, Family Percopsidae

Percopsis omiscomaycus (Walbaum)

The Troutperch, *Percopsis omiscomaycus* (Walbaum), (Fig. 49), the only member of this group present in Alaska, is found within the state only in the Porcupine and Yukon rivers, from about the mouth of the Andreafsky River on upstream. Its range extends generally southeastward across North America to West Virginia and New England. Reaches length of about 4 inches in Alaska, and rather scarce here.

FIGURE 50. Burbot, *Lota lota*.FIGURE 51. Arctic cod, *Boreogadus saida*.

CODFISHES, Family Gadidae

Key to the Species

1a. _____

Three dorsal fins and two anal fins present. 2

1b. _____

Two dorsal fins and one anal fin present.

Burbot (Fig. 50)

Lota lota (Linnaeus)

The only fresh-water codfish, the burbot is present in most Alaskan streams from the Copper River drainage north and west to the Bering Sea and the Arctic Ocean. The entire range of the species is circumpolar, with several subspecies in different parts of the world. Up to 4 feet long and 60 pounds weight. Common.

2a. (1) _____

Upper jaw longer than lower jaw. Less than 30 gill rakers. 3

2b. _____

Lower jaw equal to or longer than upper jaw. More than 30 gill rakers.

Arctic cod (Fig. 51)

Boreogadus saida (Lepechin)

A marine form, known from the Arctic Ocean and Bering Sea, sometimes enters rivers. Circumpolar in its entire range. Reaches about 1 foot maximum length. Locally abundant in the sea, but scarce in fresh water.

3a. (2) _____

Length of chin barbel equal to at least three-fourths of eye diameter (in young) to longer than eye diameter (in adults). Length of space between 2nd and 3rd dorsal fins less than eye diameter.

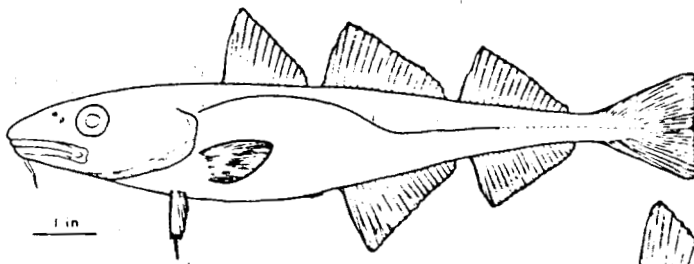


FIGURE 52. Pacific cod, *Gadus macrocephalus*.

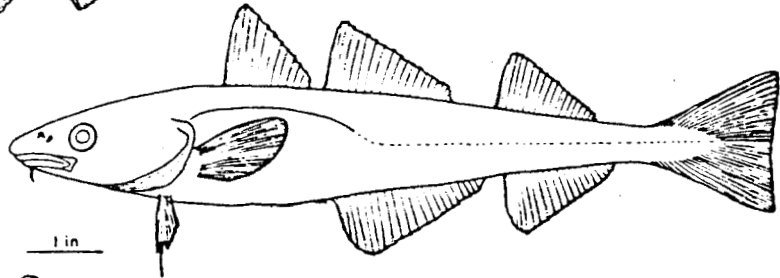


FIGURE 53. Saffron cod, *Eleginus gracilis*.

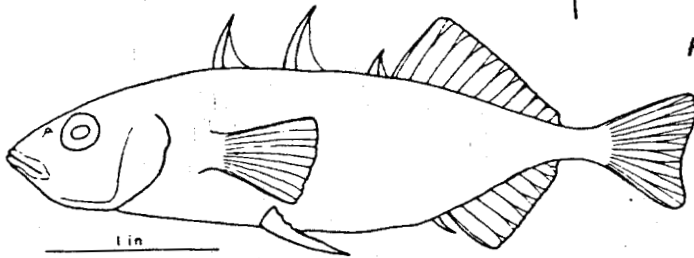


FIGURE 54. Threespine stickleback, *Gasterosteus aculeatus*.

Pacific cod (Fig. 52)

Gadus macrocephalus Tilesius

A marine species, sometimes entering rivers, found from the Bering Sea south to Oregon on the North American coast, found also on the Asian side south to the Yellow Sea and Sea of Japan. Reaches a length of about 3 feet. Abundant in the sea, but scarce in fresh water.

3b. _____

Barbel never longer than one-half eye diameter, usually about equal to or shorter than diameter of pupil. Length of space between 2nd and 3rd dorsal fins equal to or greater than eye diameter.

Saffron cod (Fig. 53)

Eleginus gracilis (Tilesius)

A marine form, sometimes enters rivers. Known from the Arctic Ocean and Bering Sea, south to Sitka on the North American side, to the Yellow Sea on the Asian side. Grows to about 2 pounds. Scarce in fresh water.

STICKLEBACKS, Family Gasterosteidae

Key to the Species

- 1a. _____
Two to four free spines, not connected by membranes, on mid-line of back in front of dorsal fin.

Threespine stickleback (Fig. 54)

Gasterosteus aculeatus Linnaeus

Found in Alaska from Southeastern to the Aleutian Islands, Bristol Bay and Saint Lawrence Island. Also present on the Seward Peninsula. Both marine and fresh-water forms are known. In western North America, the range extends south to Baja California. Also known from coastal regions in Asia, Europe and eastern North America. May attain 4 inches. Locally abundant.

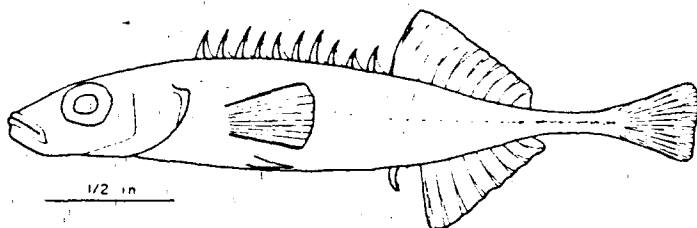


FIGURE 55. Ninespine stickleback, *Pungitius pungitius*.

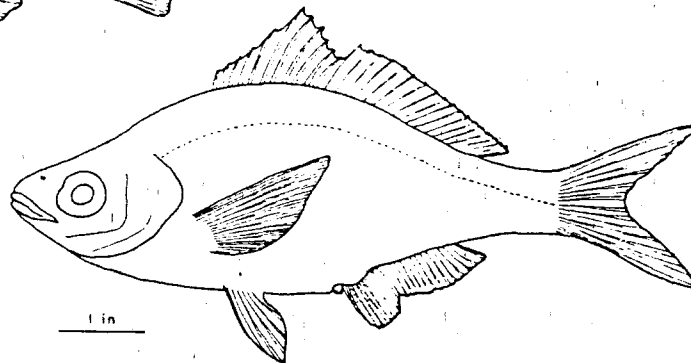


FIGURE 56. Shiner perch, *Cymatogaster aggregata*.

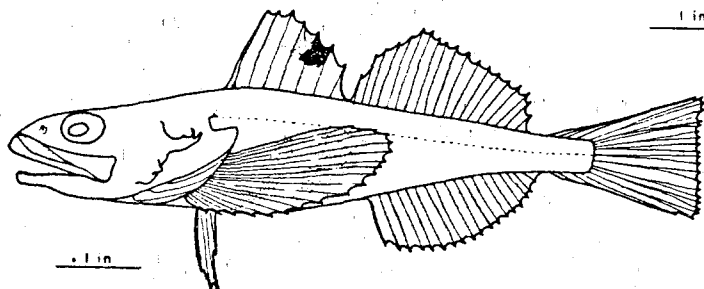


FIGURE 57. Pacific staghorn sculpin, *Leptocottus armatus*.

1b. _____
Seven to 12 free spines on mid-line of back in front of dorsal fin.

Ninespine stickleback (Fig. 55)

Pungitius pungitius (Linnaeus)

Found in Alaska in coastal regions from Cook Inlet north to the Arctic coast. Its general distribution is circumpolar. Reaches 3 to 4 inches length. Locally common.

SURFPERCHES, Family Embiotocidae

Cymatogaster aggregata Gibbons

Of the three members of this family that are found in Alaska, only one, the Shiner perch, *Cymatogaster aggregata* Gibbons, (Fig. 56), enters fresh water. It is found in South-eastern Alaska, from about Wrangell on southward. The range continues south to Todos Santos Bay, Baja California. Reaches a length of about 6 inches. Locally abundant.

SCULPINS, Family Cottidae

Key to the Species

1a. _____
Dorsal fins touching each other or only very slightly separated 2

1b. _____
Dorsal fins well separated 6

2a. (1) _____
Upper spine on preoperculum moderately long, branched, antler-like, with 3 or 4 spinules.

Pacific staghorn sculpin (Fig. 57)

Leptocottus armatus Girard

In Alaska, found from Kodiak to South-eastern, in both marine and fresh waters. Ranges south to San Quintin Bay, Baja California. Up to 18 inches long. Often quite abundant.

FIGURE 58. Slimy sculpin, *Cottus cognatus*.
A. Under side of the head to show the two pores at the tip of the chin.

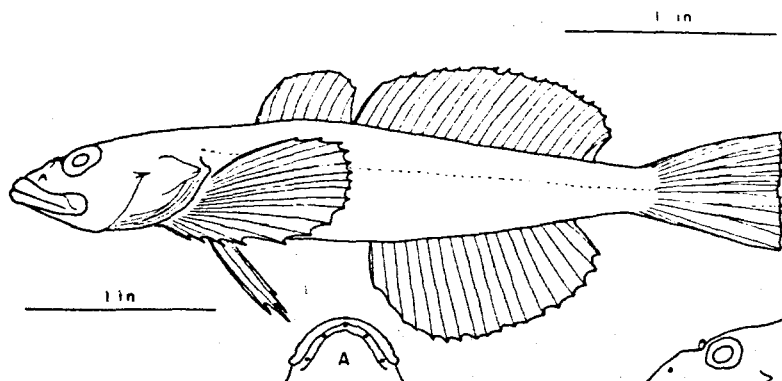


FIGURE 59. Prickly sculpin, *Cottus asper*.
A. Under side of the head to show the single pore at the tip of the chin.

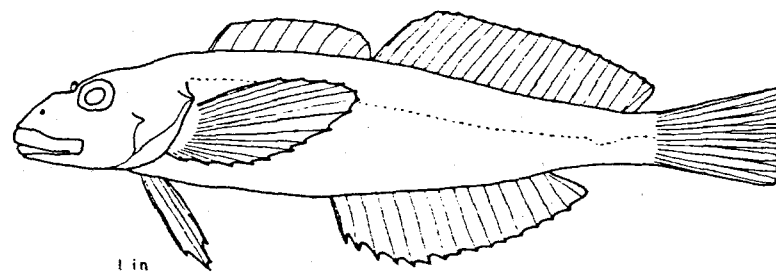


FIGURE 60. Coastrange sculpin, *Cottus aleuticus*.

2b. _____

Upper preopercular spine short, simple, not branched. 3

3a. (2) _____

Lateral line ends under middle of second dorsal fin, although there may be isolated pores farther behind. Two pores on tip of chin at mid-line. (Fig. 58A).

Slimy sculpin (Fig. 58)

Cottus cognatus Richardson

Found in Alaska from the Copper River drainage north and west to streams emptying into the Bering Sea and Arctic Ocean. Generally present throughout the Interior and also on Saint Lawrence Island. Distributed from eastern Siberia eastward across northern North America to the east coast, south as far as the Great Lakes, with a few isolated populations even farther south. Does not exceed 5 inches in length. Common.

3b. _____

Lateral line extends to behind anal fin. One pore on tip of chin at mid-line (Fig. 59A). 4

4a. (3) _____

Palatine teeth present, well developed (Fig. 3).

Prickly sculpin (Fig. 59)

Cottus asper Richardson

The range of this species in Alaska is in the coastal streams from the Kenai Peninsula southward. Outside Alaska, the prickly sculpin is found as far south as the Ventura River, California. Also present in the upper reaches of the Peace River in the Mackenzie system. Usually less than 6 inches long, but may reach a foot. Common.

4b. _____

Palatine teeth absent or only poorly developed. 5

5a. (4) _____

Pelvic fins long, reaching anus. Anal rays 13-14.

Coastrange sculpin (Fig. 60)

Cottus aleuticus Gilbert

Ranges in Alaska from Southeastern north to the Aleutian Islands and Bristol Bay. An isolated population is present in the Kobuk River. It was once reported from the mouth

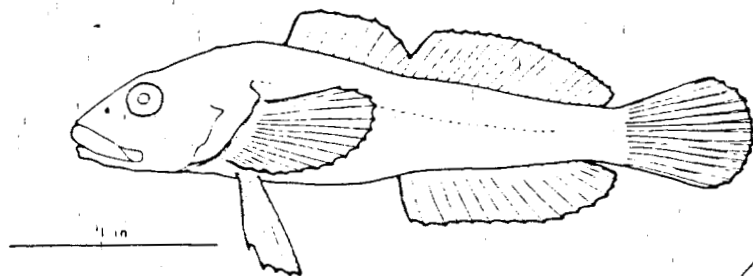


FIGURE 61. Riffle sculpin, *Cottus gulosus*.

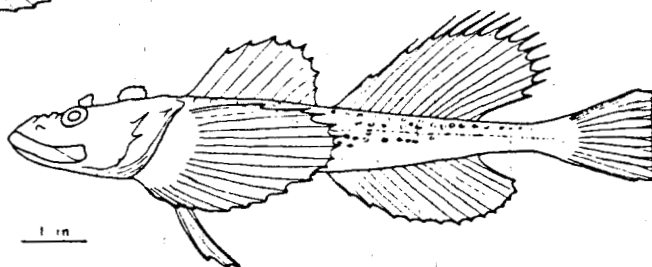


FIGURE 62. Fourhorn sculpin, *Myoxocephalus quadricornis*.

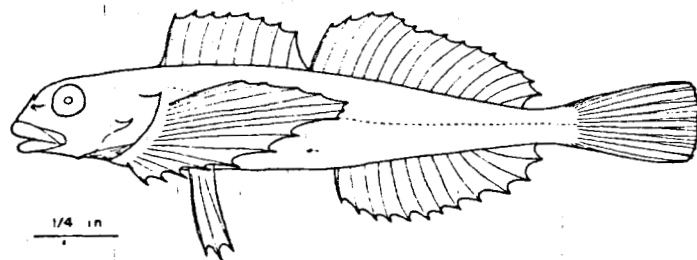


FIGURE 63. Sharpnose sculpin, *Clinocottus acuticeps*.

of the Tanana River, but this was probably a mistake in identification. Ranges southward in coastal streams to San Luis Obispo County, California. Up to about 4 inches. Common.

5b.

Pelvic fins short, not reaching anus. Anal rays 16-18.

Riffle sculpin (Fig. 61)

Cottus gulosus (Girard)

This species has been recorded from Alaska only at Loring and the Boca de Quadra. These records are probably based on wrong identifications.

6a. (1)

Two spines on preoperculum. No teeth on palatine bones in roof of mouth.

Fourhorn sculpin (Fig. 62)

Myoxocephalus quadricornis (Linnaeus)

A marine form that may range well up into

fresh-water streams. In Alaska, found from about Saint Michael northward, and along the Arctic coast. Has been found nearly 100 miles up the Meade River. Also present on Saint Lawrence Island. Virtually circumpolar, with a number of isolated populations in North America, ranges south to the Great Lakes. Up to more than a foot long in the sea, fresh-water populations much smaller. Fairly common locally.

6b.

One spine on preoperculum. Teeth present on palatine bones.

Sharpnose sculpin (Fig. 63)

Clinocottus acuticeps (Gilbert)

A normally marine species that sometimes enters fresh water, this form is found from the Aleutian Islands southward. Possibly present also in the Bering Sea, it ranges south as far as the Big Sur River in California. Up to about 2 inches long. Not common.

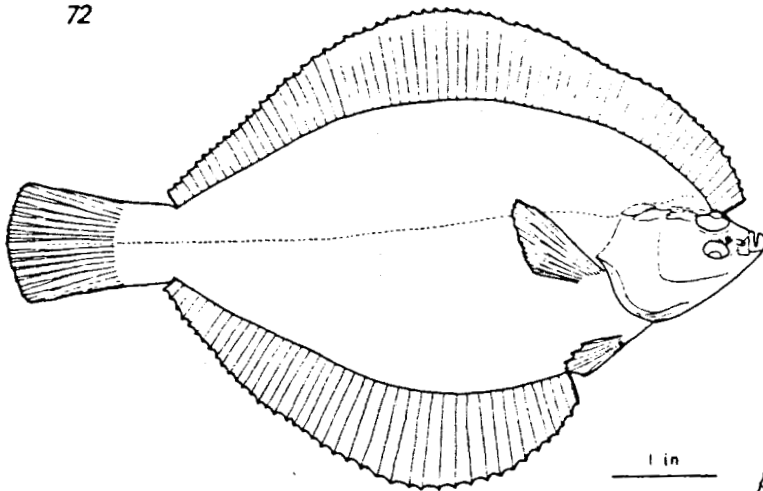


FIGURE 64. Arctic flounder, *Liopsetta glacialis*.

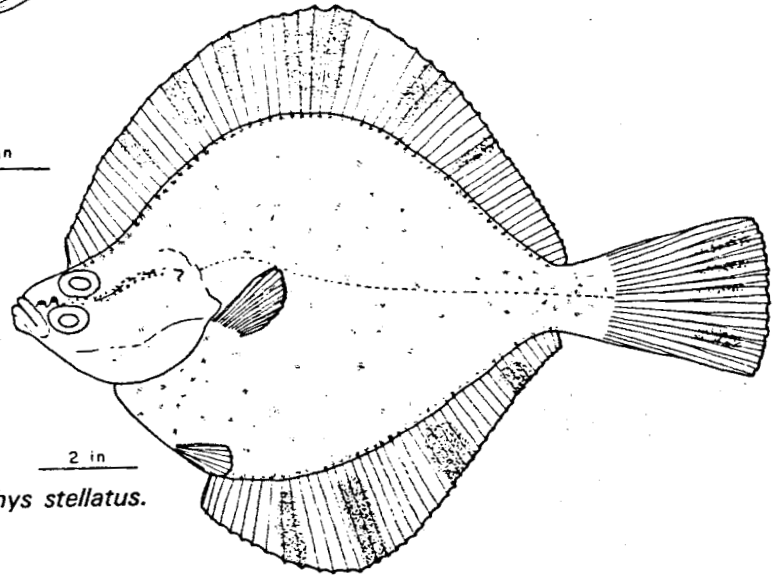


FIGURE 65. Starry flounder, *Platichthys stellatus*.

**RIGHT EYE FLOUNDERS,
Family Pleuronectidae**

Key to the Species

- 1a. _____
Fins without light and dark bands. Eyed side covered with typical scales, no bony tubercles.

Arctic flounder (Fig. 64)

Liopsetta glacialis (Pallas)

Ranges northward from the Alaska Peninsula to the Arctic Ocean. A marine fish that occasionally enters the lower reaches of rivers. Its world range is from the White Sea in Europe eastward to Bathurst Inlet in Canada, south to the Sea of Okhotsk and the Alaskan Peninsula. Probably seldom exceeds a foot in length. Rather scarce in fresh water.

- 1b. _____
Dorsal and anal fins with alternate light and dark vertical bars. Eyed side with numerous star-shaped tubercles, a row of these along bases of dorsal and anal fins.

Starry flounder (Fig. 65)

Platichthys stellatus (Pallas)

Coastal Alaska, from the Arctic on south. A marine form that sometimes enters fresh water. Note that the eye and color may be on either the right or the left side. Ranges from Bathurst Inlet in the Canadian Arctic west to the shores of Siberia, south to Korea and to Santa Barbara County, California. Up to 3 feet long and to 20 pounds weight. Common.

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315. Synopsis of biological data on the chum salmon, *Oncorhynchus keta* (Walbaum) 1792. By Richard G. Bakkala. March 1970, iii + 89 pp., 15 figs., 51 tables.
319. Bureau of Commercial Fisheries Great Lakes Fishery Laboratory, Ann Arbor, Michigan. By Bureau of Commercial Fisheries. March 1970, 8 pp., 7 figs.
330. EASTROPAC Atlas: Vols. 4, 2. Catalog No. I 49.4:330/(vol.) 11 vols. (\$4.75 each). Available from the Superintendent of Documents, Washington, D.C. 20402.
331. Guidelines for the processing of hot-smoked chub. By H. L. Seagran, J. T. Graikoski, and J. A. Emerson. January 1970, iv + 23 pp., 8 figs., 2 tables.
332. Pacific hake. (12 articles by 20 authors.) March 1970, iii + 152 pp., 72 figs., 47 tables.
333. Recommended practices for vessel sanitation and fish handling. By Edgar W. Bowman and Alfred Larsen. March 1970, iv + 27 pp., 6 figs.
335. Progress report of the Bureau of Commercial Fisheries Center for Estuarine and Menhaden Research, Pesticide Field Station, Gulf Breeze, Fla., fiscal year 1969. By the Laboratory staff. August 1970, iii + 33 pp., 29 figs., 12 tables.
336. The northern fur seal. By Ralph C. Baker, Ford Wilke, and C. Howard Baltzo. April 1970, iii + 19 pp., 13 figs.
337. Program of Division of Economic Research, Bureau of Commercial Fisheries, fiscal year 1969. By Division of Economic Research. April 1970, iii + 29 pp., 12 figs., 7 tables.
338. Bureau of Commercial Fisheries Biological Laboratory, Auke Bay, Alaska. By Bureau of Commercial Fisheries. June 1970, 8 pp., 6 figs.
339. Salmon research at Ice Harbor Dam. By Wesley J. Ebel. April 1970, 6 pp., 4 figs.
340. Bureau of Commercial Fisheries Technological Laboratory, Gloucester, Massachusetts. By Bureau of Commercial Fisheries. June 1970, 8 pp., 8 figs.
341. Report of the Bureau of Commercial Fisheries Biological Laboratory, Beaufort, N.C., for the fiscal year ending June 30, 1968. By the Laboratory staff. August 1970, iii + 24 pp., 11 figs., 16 tables.
342. Report of the Bureau of Commercial Fisheries Biological Laboratory, St. Petersburg Beach, Florida, fiscal year 1969. By the Laboratory staff. August 1970, iii + 22 pp., 20 figs., 8 tables.
343. Report of the Bureau of Commercial Fisheries Biological Laboratory, Galveston, Texas, fiscal year 1969. By the Laboratory staff. August 1970, iii + 39 pp., 23 figs., 9 tables.
344. Bureau of Commercial Fisheries Tropical Atlantic Biological Laboratory progress in research 1965-69, Miami, Florida. By Ann Weeks. October 1970, iv + 65 pp., 53 figs.
346. Sportsman's guide to handling, smoking, and preserving Great Lakes coho salmon. By Shearon Dudley, J. T. Graikoski, H. L. Seagran, and Paul M. Earl. September 1970, iii + 28 pp., 15 figs.
347. Synopsis of biological data on Pacific ocean perch, *Sebastes alutus*. By Richard L. Major and Herbert H. Shippen. December 1970, iii + 38 pp., 31 figs., 11 tables.

Continued on inside back cover.

OPERATIONAL PLAN

AKALURA, UPPER STATION AND RED LAKES SCKEYE SMOLT STUDIES, 1991



**ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF COMMERCIAL FISHERIES**

**211 MISSION ROAD
KODIAK, ALASKA 99615**

MAY 1991

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APPENDIX B: Procedure for Using AWL Mark-Sense Forms for Sampling
Adult Salmon

APPENDIX C: Presmolt Salmon Key and Anadromous Juvenile Salmonides Key

INTRODUCTION

In 1989 the commercial sockeye salmon (*Oncorhynchus nerka*) fisherys were curtailed in most of the Kodiak Management Area due to oil contamination from the 24 March 1989 EXXON VALDEZ spill. As a consequence several sockeye systems had excessive escapements. For example the Red Lake system with escapement goal an escapement goal of 300,000 fish had in excess of 750,000 fish, and the Akalura system with a 50,000 escapement goal had a 110,000 fish escapement. There is concern that the large escapements may damage future returns by a combination of factors in the freshwater environment including disease, fry starvation, and shifts in the plankton community caused by excessive predation. The project covered here addresses sockeye smolt production.

Goal

The goal is to determine if smolt production has been impacted due to surplus sockeye escapement in 1989 at Akalura Lake and Red Lake using Upper Station Lake for a control. Specific objectives and tasks are:

Objectives

1. Estimate the total number of smolt in the out-migration;
2. Estimate the age and size (weight, length, and condition factor) of smolt in the out-migration;

3. Determine smolt out-migration timing.

Tasks

1. Operate a Canadian fan trap continuously through the smolt migration;
2. Quantify the daily catch by species;
3. Sample 70 smolt per day, six days each week, for age, length, and weight through the migration;
4. One day each week, mark five hundred trap caught sockeye smolt using Bismark Brown Y dye for release upstream of the catch location to determine trap efficiency and allow estimation of total smolt numbers;
5. Collect and preserve 3-50 sockeye smolt samples from the out-migration for microstructural analysis of otolith patterns;
6. Collect and preserve 40 smolt from the out-migration for nitrogen analysis.

SUPERVISION

The Field Project Leaders are Bruce Barrett and Charles Swanton. The field staff and crew leaders are:

Akalura	Chris Hicks	- Crew Leader
	George Malone	- Crew
Upper Station	Dave Kaplan	- Crew Leader
	Scott Marx	- Crew
Red Lake	Terry Giegerich	- Crew Leader
	Tim Dalton	- Crew

The crew leaders are responsible for making daily work assignments and ensuring that operations are conducted safely and according to the standards defined in this manual. Swanton and Barrett will administratively oversee the program which will include ensuring that adequate logistic, equipment, and technical support are provided.

PROCEDURES

A Canadian fan trap will be fished at the outlet stream of each lake except at Red Lake where two traps will be used. Each trap will be fitted with a live box, anchored at the upstream and using fence posts and polyrope.

The Akalura smolt trap will be fished in the first stream riffle upstream of the adult salmon weir site which is at the upper limit of intertidal influence. The Upper Station trap will be situated in the outlet stream of Lower Upper Station Lake about 1/2 mile below the lake. The Red Lake traps will be in the outlet creek one mile below the lake. All traps are to be operating by 7 May 1991. Generally each trap will be situated mid channel and at the tail of a riffle where velocity (>1 ft/sec) and depth (>1 ft.) are sufficient for enough flow through the trap to minimize fish avoidance problems. Depending on the flow conditions and size of the trap aperture, perforated smolt panels may be used for leads to enhance trap efficiency. After the initial set-up and evaluation, if a trap is repositioned or lead material is added or deleted the action should be well documented in the comment section of the daily catch reporting form (Figure 1). This is important because of the likely change in the gear efficiency.

Figure 1.

DAILY SMOLT TRAP CATCH REPORTING FORM

PROJECT LOCATION: _____

DATE: _____

Time (Military)	Sockeye		Coho Fry	Dolly Varden	Stickle- back	other	Comments
	Smolt	Fry					
TOTAL							

Each trap will be checked as often as necessary to maintain the trap efficiency and minimize any fish mortalities. Minimally the traps should be checked every 30 minutes between the hours of sunset and sunrise. During daylight hours normally a check once every four hours is adequate. Although smolt generally outmigrate in the evening hours there is evidence of large smolt movements occurring in hours of mid afternoon coinciding major weather changes including rain storms. It is essential that each crew keep a close vigilance on the assigned smolt trap. Unfortunately there are numerous instances where crew vigilance has been less than desirable and thousands of smolts have been overcrowded and killed solely due to crew inattentiveness.

There are two methods for determining the species catch in a trap. The simplest and most common procedure is to individually count the fish by species while emptying the live box with a dipnet. More specifically the catch is transferred by dipnet into a partially water filled 5-gallon plastic bucket, and the fish are individually counted in the process of spilling the contents of the bucket in the stream below the trap. The second method involves a catch-weight sampling procedure where the catch is transferred by dipnet into a small mesh netted basket suspended over the creek from a hanging scale. The aggregate weight of the catch is then recorded and the process is continued until the live box is emptied. During the catch-weight sampling process samples are taken to determine species count by weight. This involves counting the number of fish by species from a known aggregate weight obtained using a hanging scale. Generally the rule will be to sample every tenth dipnet of fish for a species count by weight. The second method should only be used when there are relatively large number of smolt being caught, and there is not enough time to count all the fish without incurring mortalities. The daily smolt count data will be recorded on the forms in Figures 1 and 2.

Date: _____ Time Period (military): _____ to _____ Project Location: _____

Basket Weight (wet): _____

1.	11.	21.	31.
2.	12.	22.	32.
3.	13.	23.	33.
4.	14.	24.	34.
5.	15.	25.	35.
6.	16.	26.	36.
7.	17.	27.	37.
8.	18.	28.	38.
9.	19.	29.	39.
10.	20.	30.	40.

Totals: _____ + _____ + _____ = GRAND TOTAL

GRAND TOTAL LESS BASKET WEIGHTS (a): _____

	SAMPLE BIOMASS (Fish plus basket weight)	CATCH	
		Sockeye Smolt	Other
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____
4.	_____	_____	_____
5.	_____	_____	_____
Sub-total	_____	_____ (c)	_____ (d)
TOTAL (less basket wts.)	_____ (b)		

ESTIMATED CATCH: _____ Smolt (ac/b); _____ Other (ad/b)

Trap efficiency will be estimated weekly by a simple mark and recapture method. This will entail placing about 500 smolt into a holding tank of water containing Bismark Brown Y dye (1 g per 30 l of water for 30 minutes; 1 U.S. gallon=3.8 liters) which will tint the smolt and make them readily distinguishable from undyed smolt. The dyed fish in the holding tank, will be transferred to 5-gallon plastic buckets, which will be oxygenated, and back-packed 0.5 miles upstream to an in-stream holding box. The marked fish will be held in the recovery box for about 30 minutes for acclimation. Only live, robust smolt will be released. The marked fish will be released evenly across the stream channel. For three days following a release all fish caught in the trap will be checked for the dye mark. During the recovery period if the catch weight sampling procedure is implemented, the crew is to sample for both the number of fish caught per sample weight and the number of dyed fish caught per sample weight. Trap efficiency will be determined by the proportion of marked fish recovered. The mark and recapture data will be recorded on the form in Figure 3.

At each location 70 sockeye smolt per day, six days per week, are to be sampled for age, length, and weight. Specific procedures for collecting and recording the information is in Appendix A and B. Each sample will be taken from a single days catch. Do not mix samples between days. If less than 70 fish are caught in a day the sample size for that day will be the number of fish caught on that day. Since smolt primarily migrate at night a single sampling day will be the 24-h period from noon to noon and will be identified by the calendar date corresponding to the first noon.

Figure 3.

SOCKEYE SALMON SMOLT SUMMARY REPORT

PROJECT LOCATION: _____

DATE (Day, Month, Year)	TOTAL # SMOLT CAUGHT	TOTAL # SMOLT MORT.	TOTAL # DYED SMOLT RELEASED	TOTAL # SMOLT EXAMINED FOR MARKS	TOTAL # DYED SMOLT RECAPTURED

Three 50-fish size otolith samples will be collected at each location: at the onset, near the midpoint, and at the end of the migration. The procedure for collection is straight forward. Simply take 50 fish (randomly) that have been captured in the trap and put them into a polybottle filled with 90% Ethanol. Take care to accurately label the bottle with the following information: the origin of capture and the date. Additionally, include the same information on a piece of write-in-the-rain paper and drop it in with the fish. The percentage of preservative to fish is critical. Have no more than 25% fish in any bottle which means 75% preservative. This may seem like a waste of preservative but any less than this leaves a lot of tissue on the otoliths.

A single 40-fish sample (preferably all age 1 smolt) will be collected near the midpoint of the run. The fish will individually be stored in vials and kept chilled (frozen if possible). Coordinate the collection with an out-going flight to insure the fish reach Kodiak fresh.

Fish species identification keys are in Appendix C.

Climatological data will be collected at each location daily at approximately 1800 hrs. The information will be recorded on the form in Figure 4 and will include water and air temperatures, stream height, percent cloud cover, and wind direction and velocity.

The smolt traps will be removed at the end of the smolt migration which is expected to be about 21 June. The exception is at Upper Station where smolt monitoring will continue through about 30 July to ensure that the age 0 smolt migration is evaluated.

Figure 4.

CLIMATOLOGICAL OBSERVATIONS

PROJECT LOCATION: _____

DATE	TIME	TEMP		CLOUD COVER (%)	WIND		STREAM GAUGE (0.1 FT)	COMMENTS
		AIR	WATER		DIRECTION	VEL. (mph)		

APPENDIX A

Procedures for Sampling Salmon Smolt

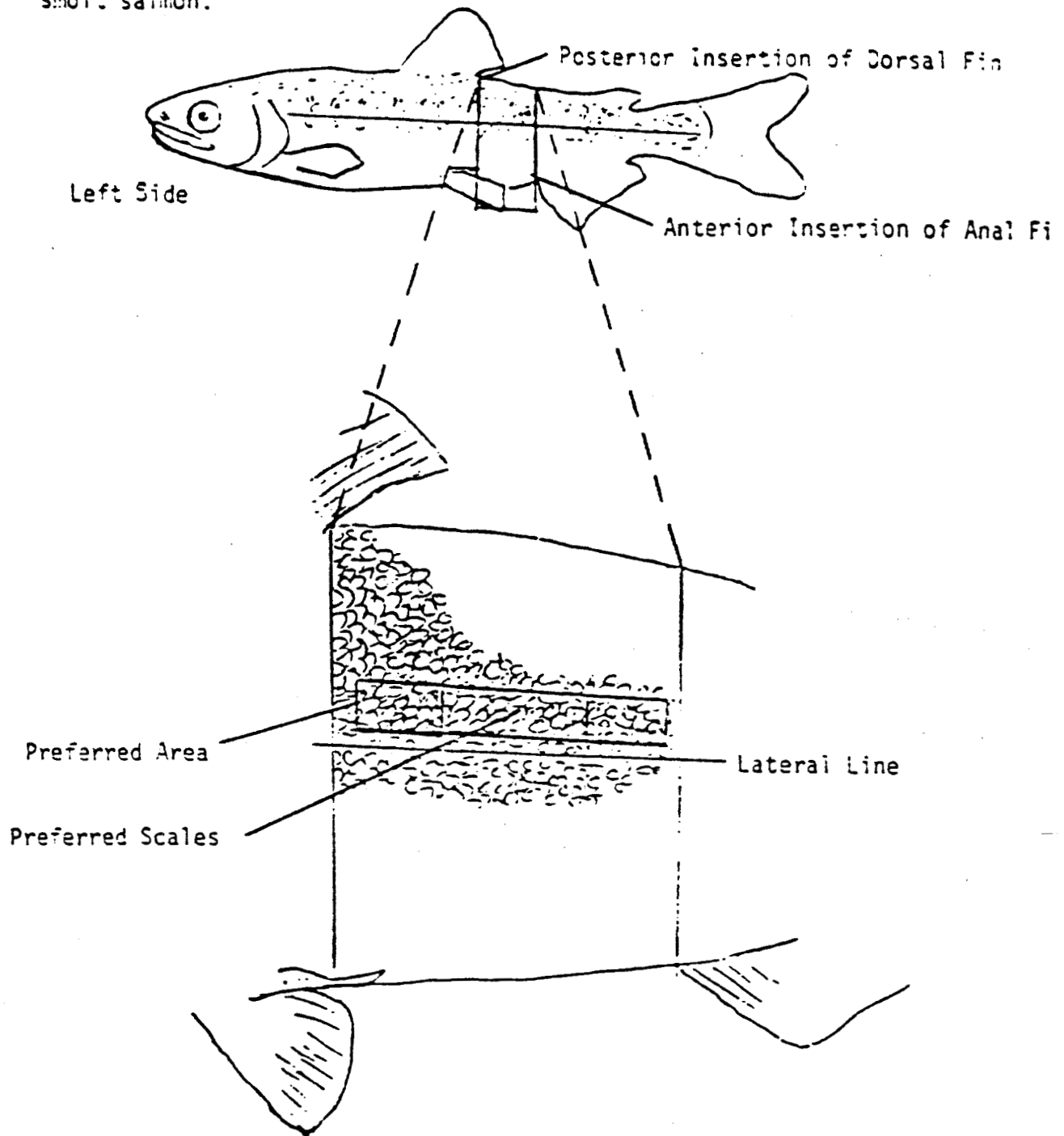
The sample size goal per week is 70 sockeye salmon smolt per day, six days a week. It is essential that the sample be taken randomly. In the event that more than the required sample size is in the smolt trap at the time of sampling the trap is to be stirred to assure randomness. When the smolt are randomly distributed a small dip net will be used to remove a subsample, this procedure will be repeated until the sample goal is met.

Smolt samples will be kept alive and worked the day of capture. MS222 will be used to anesthetize the fish. The use of this chemical will be demonstrated in the field. Age, weight, and length data will be recorded on adult AWL forms (Appendix A.1), as no smolt AWL forms exist. Refer to Appendix B on the standard procedures for recording data on an AWL form. Record at the top of each AWL form: personnel collecting the data.

A knife will be used to remove 5-10 scales from the preferred area, Appendix A.2. The scales will be mounted on a glass slide as illustrated in Appendix A.3. The left portion of each slide will be labeled with: sample site, location, date, and specimen number. Smolt lengths will be measured to the nearest millimeter, from the tip of the snout to the fork of the tail, Appendix A.4.

Excess water will be removed from the smolt before weighing by using a paper towel as a blotter. Individual smolt weights will be recorded to the nearest 0.1 gram

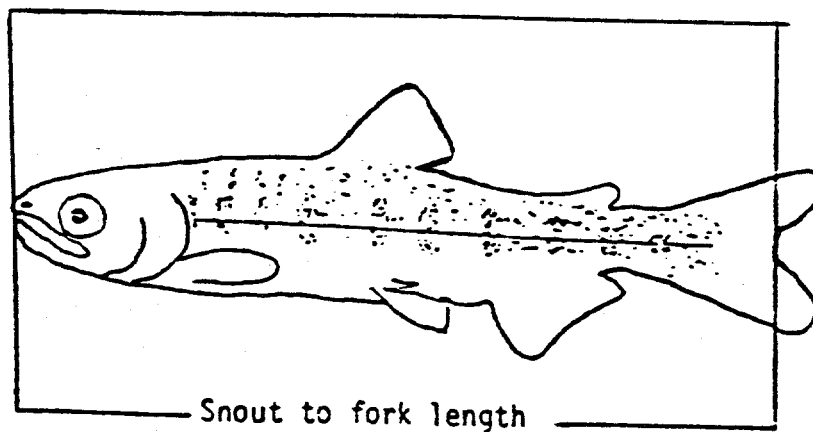
Appendix A.2. Scale sampling procedure showing the preferred scale sampling area on a smolt salmon.



Appendix A.3. Salmon smolt glass slide example.

Location	Bear River				
Collection Date	7/02/85	o	o	o	o
Fish Reference Number	#100-104	o	o	o	o
Collector	Whelan	o	o	o	o
Collector	Perry	o	o	o	o
		Number	Number	Number	Number
		100	101	102	103
					104

Appendix A.4. Measuring smolt length.



APPENDIX B

Procedure for Using AWL Mark-Sense Forms

For Sampling Adult Salmon

Length, Sex, and Scale Sampling Procedure for Sampling:
Using Mark-Sense Forms
(Recommended by Statewide Stock Biology Group, May 1985)

INTRODUCTION

Salmon from the catch are sampled for length, sex, and scales annually by field crews throughout the state. This data base is essential to sound management of the State's salmon resources. This information is drawn upon by management and research biologists for: (1) forecasting run strengths; (2) setting escapement goals; (3) examining the productivity of each system; (4) salmon growth analysis; (5) catch apportionment (based on age composition and/or scale pattern analysis); (6) in-season run estimation; and (7) to gain a better understanding of the biology of each stock.

For clarification purposes a SCALE SAMPLE and SUB-SAMPLE will be defined as follows:

SCALE SAMPLE: A data set collected from a specific sampling location, containing scales and data from a single species, collected during a single year. All data forms and scale cards of a single SAMPLE have the same statistical code. AWL and scale card number in a sample are consecutively and chronologically ordered.

SUB-SAMPLE: Any portion of a scale sample consisting of consecutively numbered AWL's and scale cards. SUB-SAMPLES usually consist of one or more time segments of a sample.

To be useful, data must be recorded on the mark-sense forms neatly and accurately. The following procedures are to be adhered to when sampling for length, sex, and scales using mark-sense AWL forms.

COMPLETING THE FORMS:

A completed mark-sense AWL form and accompanying gum card for sampling commercial catches of sockeye and chum salmon are shown in Appendix B.1. A completed AWL form and accompanying gum cards for sampling commercial catches of chinook and coho salmon are shown in Appendix B.2.

Complete each section of the left side of the mark-sense form using a soft No. 2 pencil and darken the corresponding blocks as shown in the figures. Make every effort to darken the entire block as partially filled blocks are often missed by the optical scanner which reads and records the data from the mark-sense AWL forms. Label only one form at a time to avoid "the carbon paper effect" and resulting stray marks.

Description:

For escapement sampling: Species/Area/Catch or Escapement/gear type i.e. weir/Samplers (name and W-R-P)

DO NOT WRITE IN THIS MARGIN

102661

DESCRIPTION AREA: Nelson Lagoon

Samplers: W. Tracy McKinnon
P. Joann Mitchell
R. Jim McCullough

Scale Readers: Tracy McKinnon

ADULT ADULT SALMON AGE LENGTH
FORM VERSION 2.1

DATE	100's	LENGTH	5's	AGE GROUP	AGE ERROR CODE
083					
SPECIES 2					
CATCH DATE 26					
MONTH 6					
YEAR 87					
DISTRICT 313					
SUBDISTRICT 30					
LOCATION PORT Moller					
PERIOD 26					
PROJECT 1					
GEAR 1					
MESH					
TYPE OF LENGTH MEASUREMENT 2					
NUMBER SCALES FISH 1					
NO. OF CARDS 1					

EXAMPLE

Fish # 1 →

Fish # 2 →

Fish # 3 →

Fish # 13 →

Fish # 14 →

Fish # 15 →

Fish # 25 →

Fish # 26 →

Fish # 27 →

Fish # 38 →

Fish # 39 →

Fish # 40 →

Appendix B.1. Example of AWL and gum cards for sampling one scale per fish.

Species: Sockeye Card No 083
 Locality: Nelson Lagoon Catch
 Stat Code: 313-30
 Sampling Date: Mo 6 Day 26 Year 87
 Gear: Purse Seine
 Collector(s): McCullough, Mitchell, McKinnon
 Remarks: _____

1

AREA: Moller to Seniavin

Samplers: W - Tracy McKinnon
P - Jordan Mitchell
R - Jim McCullough

Scale readers: McKinnon

ADP60 ADULT SALMON AGE LENGTH FORM VERSION 2.1

DO NOT WRITE IN THIS MARGIN

103328

001
A, B, C,
Chinook
DAY (caught)
20
MONTH
6
YEAR
87
DISTRICT
315
SUBDISTRICT
STREAM
LOCATION
Port Moller
PERIOD
PROJECT
YEAR
FISH
TYPE OF
LENGTH
MEASUREMENT
NUMBER
SCALES
FISH
OF CALLUS

001A

001B

001C

001D

001E

001F

001G

001H

001I

001J

001K

001L

001M

001N

001O

001P

001Q

001R

001S

001T

001U

001V

001W

001X

001Y

001Z

001AA

001AB

001AC

001AD

001AE

001AF

001AG

001AH

001AI

001AJ

001AK

001AL

001AM

001AN

001AO

001AP

001AQ

001AR

001AS

001AT

001AU

001AV

001AW

001AX

001AY

001AZ

001BA

001BB

001BC

001BD

001BE

001BF

001BG

001BH

001BI

001BJ

001BK

001BL

001BM

001BN

001BO

001BP

001BQ

001BR

001BS

001BT

001BU

001BV

001BW

001BX

001BY

001BZ

001CA

001CB

001CC

001CD

001CE

001CF

001CG

001CH

001CI

001CJ

001CK

001CL

001CM

001CN

001CO

001CP

001CQ

001CR

001CS

001CT

001CU

001CV

001CW

001CX

001CY

001CZ

001DA

001DB

001DC

001DD

001DE

001DF

001DG

001DH

001DI

001DJ

001DK

001DL

001DM

001DN

001DO

001DP

001DQ

001DR

001DS

001DT

001DU

001DV

001DW

001DX

001DY

001DZ

001EA

001EB

001EC

001ED

001EE

001EF

001EG

001EH

001EI

001EJ

001EK

001EL

001EM

001EN

001EO

001EP

001EQ

001ER

001ES

001ET

001EU

001EV

001EW

001EX

001EY

001EZ

001FA

001FB

001FC

001FD

001FE

001FF

001FG

001FH

001FI

001FJ

001FK

001FL

001FM

001FN

001FO

001FP

001FQ

001FR

001FS

001FT

001FU

001FV

001FW

001FX

001FY

001FZ

001GA

001GB

001GC

001GD

001GE

001GF

001GG

001GH

001GI

001GJ

001GK

001GL

001GM

001GN

001GO

001GP

001GQ

001GR

001GS

001GT

001GU

001GV

001GW

001GX

001GY

001GZ

001HA

001HB

001HC

001HD

001HE

001HF

001HG

001HH

001HI

001HJ

001HK

001HL

001HM

001HN

001HO

001HP

001HQ

001HR

001HS

001HT

001HU

001HV

001HW

001HX

001HY

001HZ

001IA

001IB

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001IN

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001IP

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001IS

001IT

001IU

001IV

001IW

001IX

001IY

001IZ

001JA

001JB

001JC

001JD

001JE

001JF

001JG

001JH

001JI

001JJ

001JK

001JL

001JM

001JN

001JO

001JP

001JQ

001JR

001JS

001JT

001JU

001JV

001JW

001JX

001JY

001JZ

001KA

001KB

001KC

001KD

001KE

001KF

001KG

001KH

001KI

001KJ

001KK

001KL

001KM

001KN

001KO

001KP

001KQ

001KR

001KS

001KT

001KU

001KV

001KW

001KX

001KY

001KZ

001LA

001LB

001LC

001LD

001LE

001LF

001LG

001LH

001LI

001LJ

001LK

001LL

001LM

001LN

001LO

001LP

001LQ

001LR

001LS

001LT

001LU

001LV

001LW

001LX

001LY

001LZ

001MA

001MB

001MC

001MD

001ME

001MF

001MG

001MH

001MI

001MJ

001MK

001ML

001MM

001MN

001MO

001MP

001MQ

001MR

001MS

001MT

001MU

001MV

001MW

001MX

001MY

001MZ

001NA

001NB

001NC

001ND

001NE

001NF

001NG

001NH

001NI

001NJ

001NK

001NL

001NM

001NN

001NO

001NP

001NQ

001NR

001NS

001NT

001NU

001NV

001NW

001NX

001NY

001NZ

001OA

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001PG

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001PI

001PJ

001PK

001PL

001PM

001PN

001PO

001PP

001PQ

001PR

001PS

001PT

001PU

001PV

001PW

001PX

001PY

001PZ

001QA

001QB

001QC

001QD

001QE

001QF

001QG

001QH

001QI

001QJ

001QK

001QL

001QM

001QN

001QO

001QP

001QQ

001QR

001QS

001QT

001QU

001QV

001QW

001QX

001QY

001QZ

001RA

001RB

001RC

001RD

001RE

001RF

001RG

001RH

001RI

001RJ

001RK

001RL

001RM

001RN

001RO

001RP

001RQ

001RR

001RS

001RT

001RU

001RV

001RW

001RX

001RY

001RZ

001SA

001SB

001SC

001SD

001SE

001SF

001SG

001SH

001SI

001SJ

001SK

001SL

001SM

001SN

001SO

001SP

001SQ

001SR

001SS

001ST

001SU

001SV

001SW

001SX

001SY

001SZ

001TA

001TB

001TC

001TD

001TE

001TF

001TG

001TH

001TI

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001UE

001UF

001UG

001UH

001UI

001UJ

001UK

001UL

001UM

001UN

001UO

001UP

001UQ

001UR

001US

001UT

001UU

001UV

001UW

001UX

001UY

001UZ

001VA

001VB

001VC

001VD

001VE

001VF

001VG

001VH

001VI

001VJ

001VK

001VL

001VM

001VN

001VO

001VP

001VQ

001VR

001VS

001VT

001VU

001VV

001VW

001VX

001VY

001VZ

001WA

001WB

001WC

001WD

001WE

001WF

001WG

001WH

001WI

001WJ

001WK

001WL

001WM

001WN

001WO

001WP

001WQ

001WR

001WS

001WT

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001XH

001XI

001XJ

001XK

001XL

001XM

001XN

001XO

001XP

001XQ

001XR

001XS

001XT

001XU

001XV

001XW

001XX

001XY

001XZ

001YA

001YB

001YC

001YD

001YE

001YF

001YG

001YH

001YI

001YJ

001YK

001YL

001YM

001YN

001YO

001YP

001YQ

001YR

001YS

001YT

001YU

001YV

001YW

001YX

001YY

001YZ

001ZA

001ZB

001ZC

001ZD

001ZE

001ZF

001ZG

001ZH

001ZI

001ZJ

001ZK

001ZL

001ZM

001ZN

001ZO

001ZP

001ZQ

001ZR

001ZS

001ZT

001ZU

001ZV

001ZW

001ZX

001ZY

001ZZ

Appendix B.2.

Example of AWL and gum cards for sampling more than one scale per fish.

Species: Chinook Card No. 001A
Locality: Moller to Seniavin Catch
Stat Code: 315
Sampling Date Mo 20 Day 6 Year 87
Gear: purse seine
Collector(s): McKinnon, Mitchell, McCullough
Remarks: 3 scales per fish

Species: Chinook Card No. 001B
Locality: Moller to Seniavin
Stat Code: 315
Sampling Date Mo 20 Day 6 Year 87
Gear: purse seine
Collector(s): McKinnon, Mitchell, McCullough
Remarks: 3 scales per fish

Species: Chinook Card No. 001C
Locality: Moller to Seniavin Catch
Stat Code: 315
Sampling Date Mo 20 Day 6 Year 87
Gear: purse seine
Collector(s): McKinnon, Mitchell, McCullough
Remarks: 3 scales per fish

Card:

The AWL forms and corresponding gum card(s) are numbered sequentially by date throughout the season starting with 001. A separate numbering sequence will be used for each species, gear type, district, and geographic location. Consult your port supervisor for the current card number. Sockeye and chum samples will have only 1 card per AWL form as shown in Appendix B.1. Coho and chinook samples will contain up to four cards per AWL form as shown in Appendix B.2.

Species:

Refer to the reverse side of the AWL form for the correct digit.

Day, Month, Year:

Use appropriate digits for the date the fish are caught.

District:

List only one district. Consult project leader for appropriate district, subdistrict, and stream numbers.

Subdistrict:

List a single subdistrict if it is known and all the fish sampled were from that single subdistrict. Leave blank if more than one subdistrict is involved or if the subdistrict is unknown.

Stream:

Leave blank for catch sampling; for escapement sampling consult project leader for appropriate number.

Location:

List the appropriate code as shown on Table B.1.

Period:

List the statistical week in which the fish were caught.

Project:

Refer to the reverse side of the AWL form for the correct code.

Gear:

Refer to the reverse side of the AWL form.

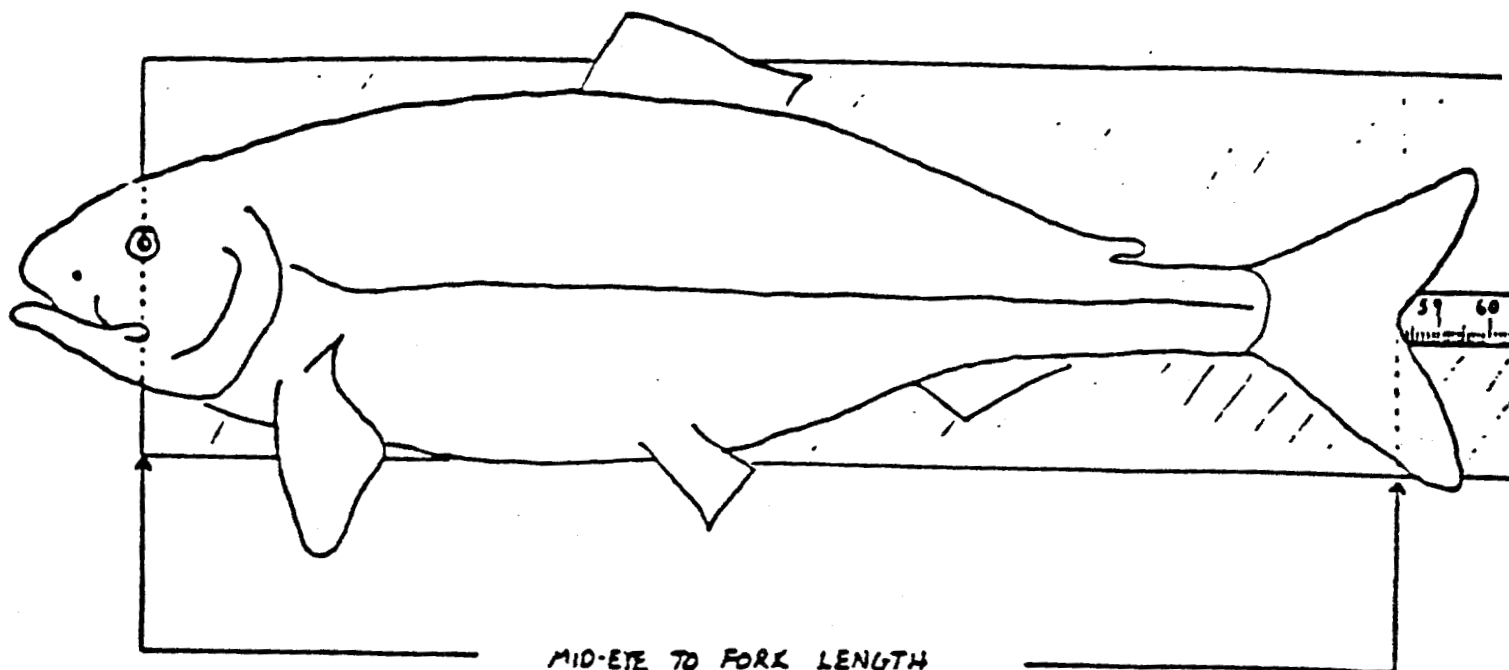
Mesh:

Leave blank unless specifically instructed by supervisor to do otherwise.

Type of length measurement:

Use (2) mid-eye to fork-of-tail (unless specifically instructed to do otherwise). Refer to Appendix B.3.

Appendix B.3. Measuring fish length.



Because the length and form of the snout of salmon changes as the fish approaches sexual maturity, length measurements are made from the middle of the eye to the fork of the tail. The length is always recorded to the nearest millimeter. The procedure for measuring length (mid-eye to fork) of the salmon is as follows:

1. Place the salmon flat on the board with the head to your left and the dorsal fin away from you.
2. Make sure your eye is directly over the end of the board. Line the eye of the salmon up with the edge of the board and hold the head in place with your left hand. It helps to place a finger in the salmon's eye for reference.
3. Flatten and spread the tail against the board with your right hand.
4. Read the mid-eye to fork length to the nearest millimeter .

of cards:

Mark 1 when sampling sockeye, chum, coho, and chinook salmon (Appendix B.1). When sampling chinook and coho salmon write the card numbers (i.e. 001A, 001B, 003B, etc.) perpendicular to the left of the fish # column as shown in Appendix B.2.

It is paramount to keep the mark-sense forms flat, dry, and clean. Fish gurry and water curling will cause data to be misinterpreted by the optical scanning machine. In general, keep the forms neat enough and legible enough to have a stranger be able to make sense out of them.

Additional data columns are available on the reverse of the AWL for individual project use. If you as a project leader use them and wish that data to be read by the opscan reader, you will need to transfer the litho code from the front of the form to the reverse.

GUM CARD(S):

Fill out the gum cards as shown in Appendices B.1 and B.2.

Species:

Write out completely (i.e., chinook, sockeye, etc.).

Locality:

For catch sampling and escapement sampling write down area in which fish were caught followed by the word catch or escapement (i.e. Karluk River escapement).

Stat. code and Sampling date:

Transfer the appropriate digits from the AWL form.

Gear:

Write out completely.

Collector(s):

Record the last name or initials of the person(s) sampling.

Remarks:

Record any pertinent information such as number of scales per fish sampled, vessel/tender name, etc. Transfer this same information to the top margin of the AWL.

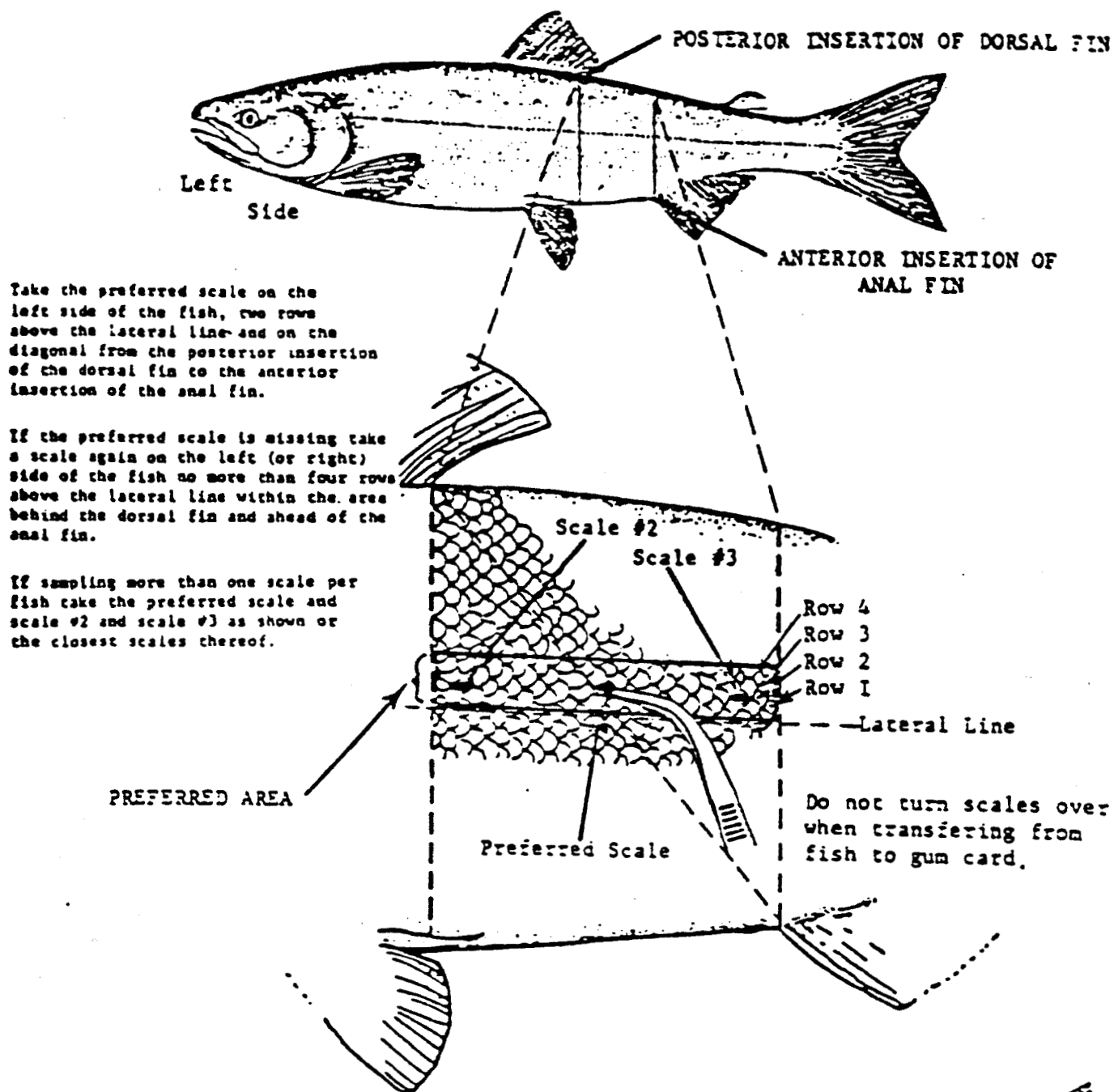
SAMPLING:

A. GENERAL

1. Sex the fish and darken M or F in the sex columns. If any difficulty was encountered in this procedure, write "I had trouble sexing these fish" on the top margin of the AWL and ask your supervisor for help as soon as possible before sexing additional fish.

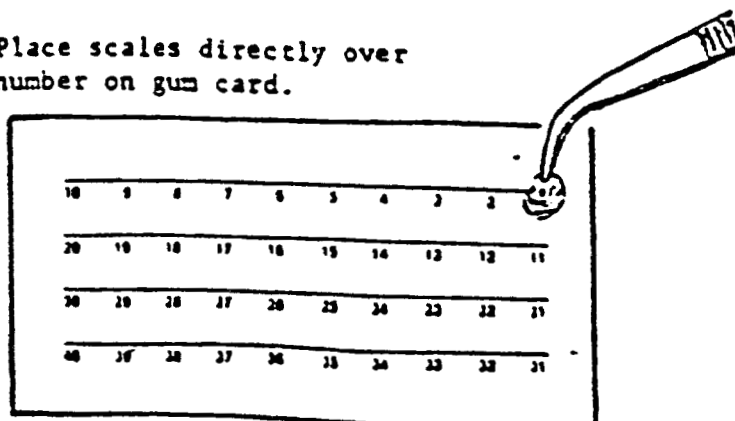
2. Measure all species' length in millimeters from the middle of the eye to the fork of the tail, refer to Appendix B.3. Record length by blackening the appropriate column blocks on the AWL form. Column 3 on the AWL form is used for fish over 999 millimeters long (Big Daddy Chinook). Measure all species of salmon to the nearest mm. Check the calipers daily, before use, to ensure the accuracy of the measurements.
3. Pluck the "preferred scale" from the fish using forceps. Remove all slime, grit, and skin from the scale by moistening and rubbing between fingers. The "preferred scale" is located on the left side of the fish, two rows above the lateral line on the diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin, refer to Appendix B.4. If the "preferred scale" is missing, select a scale within the preferred area on either the left or right side of the fish. If no scales are present in the "preferred area" on both sides of the fish, sample a scale as close to the preferred area as possible and darken the 8 under "age error code" on the AWL form.
4. Clean, moisten and mount scale on gum card directly over number 1 as shown in Appendix B.4. The side of the scale facing up on the gum card is the same as the side facing up when it was adhered to the fish. This outward facing side is referred to as the "sculptured" side of the scale. The ridges on this sculpture side can be felt with a fingernail or forceps. Mount scale with anterior end oriented toward top of gum card.
5. When sampling sockeye and chum salmon repeat steps 1 through 4 for up to 40 fish on each AWL form.
6. When taking multiple scales per fish as with chinook and coho salmon sample the "preferred scale" and scale #2 as shown in Appendix B.4. Scale #2 is one inch to the left of the "preferred scale," and is 2 rows above the lateral line. Mount the 2 scales from fish #1 over 1 and 11 on the gum card as shown in Appendix B.2. Continuing, mount the 2 scales from fish #2 over 2 and 12, etc. If sampling 3 scales, mount the scales over #1, #11, #21, etc.
7. Use plastic scale card holders to hold individual scale cards during sampling and cover the completed gum card with wax paper for storage.
8. When sampling a weired system you may use write in rain books to record the data. Keep the mark-sense forms in camp where they will be clean, dry, and flat. After sampling is done for the day transfer the data to the mark-sense forms. It is the responsibility of the data collector to transcribe the data before turning it over to the ARB.

Appendix B.4. Scale sampling procedure showing the preferred scale sampling area on an adult salmon.



NOTE: Mount scales with anterior portion of scale oriented toward top of card.

Place scales directly over number on gum card.



9. Miscellaneous:

- a. When scales are sampled in wet conditions it is difficult to mount scales in a fashion so as to result in a good scale impression being made. Glue often obscures scale features and scales frequently adhere poorly to the card. In this situation the scales should be remounted.
- b. For adipose clipped fish record the head tag number on the corresponding row in the first five columns on the reverse side of the AWL.
- c. Look down the form from two angles after the data has been recorded to pick up any glaring mistakes. A common error occurs, for instance, in placing both the 4 and 7 of a 475 mm fish in the 100's column with nothing in the 10's column.
- d. Keep all fish gurry off forms and erase any stray marks on the forms before turning them in to your supervisor.
- e. Write in all comments explicitly and completely under remarks, transfer remarks to top margin of AWL.
- f. Responsibility for accuracy lies first with the primary data collector(s). The port supervisor will return sloppy or incomplete data to individual collectors. After editing a form, place your initials next to card #, but not in left margin.

B. SAMPLING SCENARIOS:

1. Differing size crews:

- a. One person: Wrestle the fish into the measuring board, wearing a glove on one hand. Measure the fish and write the sex and length down on the measuring board to be transferred to the AWL after ten fish have been measured. Next, pluck the preferred scale(s), clean, and mount on the gum card which is taped to the AWL in the clipboard which is sitting on the end of the measuring board. After ten fish have been processed, remove the glove and record the sexes and lengths on the AWL with your clean hand. A slime rag may be helpful.
- b. Two persons:
 - (1) When sampling more than one scale per fish, one person can wrestle the fish and record data while the other plucks and mounts scales. The wrestler needs to wear a glove that he can slip off his writing hand to record the sex and length data on the AWL form.
 - (2) When sampling one scale per fish, the person plucking the scales also records the data.

- c. Three persons: One person wrestles the fish, one plucks and mounts the scales, and the third records the data.
- 2. Sampling tote to tote:
 - a. When sampling for 2 or 3 scales per fish (chinook and coho) use two persons.
 - b. When sampling for 1 scale per fish (sockeye and chum) use three persons, if available.

SCALE SAMPLING CHECKLIST

Clipboard	Pencils (No.2)	Gloves
Gum Cards	Forceps	Measuring board or calipers
AWL's	Wax paper inserts	Sampling Manual
		Plastic scale card holders

Some Reminders

1. For greater efficiency in scale reading and digitizing, mount scales with anterior end toward top of scale card.
2. AWLs should be carefully edited. Re-check header information on AWLs; make sure all available information is filled in. Take extra care to use the correct statistical week for the sampling or catch date. Page numbers should not be repeated; a frequent error is to begin a week's sample with the last page number used the week before. This is particularly important if the data is regularly sent to town; it is easy to forget which numbers were used. Crew leaders should take time to ensure that the boxes are being blackened correctly, if the boxes are sloppily marked the optical scanner records the information incorrectly or misses it entirely. Keep marks within each rectangle and completely fill them. After AWLs are edited, place editor's initial next to page number, but not in left margin.
3. Check to make sure error codes are being used correctly, i.e. error code 7 is wrong species, error code 8 is non-preferred. Error code 6 is for the use of the scale reader, it refers to the reabsorption of the scale.
4. Transfer important comments from scale cards to AWLs. After pressing scales, the cards are seldom referred to again, and important remarks can be lost. Write comments in the top margin (not on the left side) or on the reverse of the AWL. If there is not room on the AWL to completely explain the remarks, use a separate piece of paper.
5. Never put data from different dates on one AWL or one scale card. Even if only one scale is collected that day, begin a new card and AWL for the next day.
6. If weights are taken, they may be noted in the right margin of the AWL during sampling, but be sure to transfer the weights to the appropriate columns on the reverse of the AWL before submitting it to the ARB.
7. The data processing program uses the "litho code" on the AWL. (It is located in the lower left margin of the AWL.) It helps if the AWLs are used in the order of this code. It should not be hard to keep them in order if they are arranged that way before page numbering. Those who sample different areas throughout the season can arrange the litho codes in order before each sample is taken.
8. If AWLs get wrinkled or splotted they should be copied over before sending in. The optical scanning computer will misread or reject wrinkled sheets.

LENGTH, SEX AND SCALE SAMPLING PROCEDURE FOR ESCAPEMENT SAMPLING USING MARK-SENSE FORMS

Salmon from escapement are sampled for length, sex, and scales annually by field crews throughout the state, as are salmon from the catch. The information is used similarly. Data is recorded in a slightly different manner and for this reason a separate instruction section has been prepared this year for escapement sampling.

Appendix B.1 is an example of a mark-sense form filled out for escapement sampling. Data must be recorded on mark-sense forms neatly and accurately. Basically the procedures are the same as for catch sampling, with the following exceptions:

I. Mark-Sense Forms

- A. Description: For escapement sampling, Area/Samplers (name and W.R.P.). (Note: write out species completely using AFS standards listed on the reverse of the mark-sense form).
- B. Subdistrict: Complete for all escapement samples.
- C. Stream: Consult the field crew leader.
- D. Location: Fill in the appropriate location for escapement sampling. (i.e. Bear River ADF&G camp 055, Nelson River ADF&G camp 056) (Appendix B.5). If a code has not been assigned then leave blank.

II. Gum Cards

- A. Locality: Write out the locality followed by the abbreviation "ESC" (e.g. Hugh Smith ESC).

REMEMBER: Even though conditions are not the best when sampling in the field, mark-sense forms should come in neatly written, clean, and flat. Transcribe them if necessary. If gum cards get wet, remount the scales. Responsibility for data lies with the data collector(s) not the port supervisor, or "the people in Kodiak"!

Appendix B.5. Assigned port and weir location codes. (Use under location in filling out
AWL's for catch and escapement sampling.)

Port Codes

001 - Pelican
002 - Elfin Cove
003 - Sitka
004 - Juneau
005 - Petersburg
006 - Ketchikan
007 - Craig
008 - Port Alexander
009 - Metlakatla
010 - Excursion Inlet
011 - Hoonah
012 - Wrangell
013 - Out of State
014 - Kake
015 - Gedney
016 - Security Bay
017 - Meyers
018 - Pt. Baker
019 - Klawock
020 - Yakutat
030 - Lazy Bay
031 - Port of Kodiak
032 - Pauls Lake
033 - Thorshiem
034 - Afognak River
035 - Karluk River
036 - Red River
037 - Upper Station
038 - Frazer Lake
039 - Dog Salmon
040 - Akalura River
041 - Uganik River
150 - King Cove
151 - Port Moller
052 - Dutch Harbor
053 - Akutan
054 - Sand Point
055 - Bear River, ADF&G Camp
056 - Nelson River, ADF&G Camp
057 - Canoe Bay

APPENDIX C

Presmolt Salmon Key

and

Anadromous Juvenile Salmonides Key

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Robert M. White, Administrator

NATIONAL MARINE FISHERIES SERVICE

Robert W. Schoning, Director

NOAA Technical Memorandum NMFS ABFL-2

A Guide to the Collection and Identification of Presmolt Pacific Salmon in Alaska with an Illustrated Key

MILTON B. TRAUTMAN



SEATTLE, WA

NOVEMBER 1973

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Washington, D.C. 20402

A Guide to the Collection and Identification of Presmolt Pacific Salmon in Alaska with an Illustrated Key

MILTON B. TRAUTMAN¹

ABSTRACT

This field and laboratory key contains recommendations for types of equipment needed, instructions for preserving and labeling specimens, and descriptions of the characters used in identifying five species of Pacific salmon. The key is illustrated with six line figures: 1) juvenile salmon, 2) the first gill arch, 3) head with gill arch in situ, 4) first gill arch and eye for comparison with longest rakers, 5) method of counting anal fin rays, and 6) ventral surface of head showing branchiostegals. Five plates of stippled line drawings of five lengths (25 to 110 mm fork length) for each of the five species of Pacific salmon, an annotated opposable key, and a glossary are also included.

INTRODUCTION

As adults, the five species² of Pacific salmon of the genus *Oncorhynchus* inhabiting western North American waters are easily identified, but as subadults or as smolts in silvery coloration, they are less easily recognized. As juveniles less than 125 mm (5 inches) in fork length (FL), they may be quite difficult to identify. In addition, characters by which presmolt juveniles can be distinguished may vary with geographic area.

Several keys for identification of juvenile salmon have been published, most of which utilize the number, length, and shape of the gill rakers on the first gill arch; number of pyloric caeca and branchiostegals; and absence of parr marks, or if present, their size and shape (Foerster and Pritchard, 1935; Schultz, 1936; Haig-Brown, 1947; Clemens and Wilby, 1961; McPhail and Lindsey, 1970; Wilimovsky³). In addition to

the above characters, the key in this paper emphasizes and illustrates the distribution of those chromatophores (usually melanophores) which are reliable enough to aid in the specific identification of juveniles.

This key describes the characters typical of presmolt juveniles of the five species of Pacific salmon in Alaska. The common names recommended by the American Fisheries Society (Bailey et al., 1970, p. 17) are used, despite the fact that other names appear to be in more general use. These other names are inserted in parentheses after their respective species. Trouts, Atlantic salmon (*Salmo salar*), and some other salmonoids are included in the key because of their resemblance to Pacific salmon.

Before presenting the key, it appears advisable to describe the equipment and methods I recommend for preserving specimens, labeling specimens, and counting, measuring, and removing parts of specimens, so that those not acquainted with my procedures may more accurately and quickly identify their material.

¹ Professor Emeritus of Zoology, Ohio State University, Columbus, OH 43210. The author was employed in Alaska by the National Marine Fisheries Service Auke Bay Fisheries Laboratory during the summers of 1959 and 1961. The specimens were obtained and most of the drawings made at that time.

² A sixth species, *O. masou* (Brevoort), inhabits the streams of eastern Asia from the Okhotsk Sea to Formosa.

³ N. J. Wilimovsky, 1958. Provisional keys to the fishes of Alaska. On file Natl. Mar. Fish. Serv. Auke Bay Fish. Lab., Auke Bay, AK 99821.

Magnifiers: Magnification in the range of 4 to 30 will prove helpful in identification of juvenile salmon. A binocular microscope having such a range is the most satisfactory, but any type of magnifier of more than 4 power and less than 30 may be used provided it is not necessary to use one's hand to hold it—usually both hands are needed to manipulate a specimen. In the field, a binocular unit containing lenses inserted in a frame or headstrap or a jeweler's eye magnifier (especially if one wears glasses) may be used.

Forceps: Four or five inches long with straight or curved tips—for lifting fins, holding back gill covers, etc.

Scalpel: A sharp blade an inch or two long—for removing gill arches, opening body cavities, etc.

Teasing needle: A needle inserted in a wooden or metal handle—for separating closely set gill rakers, etc.

Dividers: For measuring and comparing various body parts; dividers in which one or both legs can be "broken" are the most satisfactory.

Scissors: About 6 inches long with the blades or cutting surface of about 1 inch.

Ruler: Graduated in millimeters to measure fish lengths and parts; one which includes inches also desirable.

PRESERVING SPECIMENS

The careful preserving of specimens cannot be too strongly emphasized. Much time is lost in attempting to identify improperly preserved fishes; it is only when properly preserved that they may be rapidly and correctly identified. Frequently, juvenile salmon that have died in nets become soft, bleached, and torn. For the sake of accuracy it is better not to attempt to identify such material.

To preserve juveniles, upon capture place them in a solution of 1 part Formalin to 9 parts water. If live fishes are placed in too strong a Formalin solution, they may die with their mouths widely agape or the chromatophores may close so tightly as to be difficult to detect. If placed in too weak a Formalin solution, the fishes become bleached and soft and may decompose. If fishes are to be preserved for more than a year (or permanently),

and if possible no longer than 4 mo. When fish are removed from the Formalin solution, soak them in water for 24 to 48 hr; then place them in a solution containing 70% ethyl alcohol and 30% water or 35% isopropyl alcohol and 65% water.

Do not crowd or pack fishes in a container, especially if they are alive or only recently dead. Fresh fishes, if packed too tightly, will become permanently deformed upon hardening in Formalin, will be bleached where their bodies come in close contact, or will decompose. A container is too crowded if the fishes will not readily move as the container is slowly rotated or shaken. When sufficient room is allowed, identification will be facilitated because the fishes will harden without discoloring; bodies and fins will not be deformed, twisted, or broken; and the chromatophores will remain nearly or fully open.

LABELING SPECIMENS

Labeling specimens fully and properly is of great importance; unlabeled or mislabeled specimens are of little or no value. Put the label with the specimens at the time the fishes are preserved. Label paper should remain firm when wet and should not become pulpy. Write clearly with pencil or permanent ink, recording the following data.

Field Number

Use your own or a department number. A satisfactory method is to use the first initial of your surname or your full surname, the last two digits of the year, and your collection number. Thus, if Joe Brown in 1962 preserves his fifth collection, he writes B-62-5 or Brown-62-5; if for the Department of Salmon Investigations he writes, SI-62-5. When a departmental symbol is used, it often is desirable for the collector to add his initials or name to the label.

Name of Water Body and Locality

Use names on standard maps. Whenever possible, avoid temporary or local names, such as

Brown's fishing camp. An example of a brief but adequate recording is: Alaska, Naknek River System, Katmai National Monument, Brooks Lake.

Date

Include the month, day, and year and, if pertinent, the hour.

The following additional information may be needed at times.

Method of Capture

Describe type of gear and size if significant, i.e., seine (2 cm mesh), fry net (1 cm mesh), trawl (1 cm bag), etc.

Temperature

Measure temperature of air and/or water. If water is ice-covered, what percent?

Other Water Conditions

If a *stream*: estimate its average width and maximum depth; if tidal and brackish, to what

extent; degree of turbidity and source—glacial silt, plankton, etc.; degree of gradient—low, moderate, or high; percentage of stream in pools, with or without current; percentage of stream in riffles, whether flow is sluggish, moderate, or swift; dominant bottom types—sand, gravel, boulders, bedrock, muck, silt, etc.; aquatic vegetation—submerged, emergent, or both (name dominant species or genera if known). If a *lake or bay*: state whether fresh, brackish, or saline; if tidal, state to what extent; estimate size and possible depth; give degree of turbidity, type of bottom, and amount and kinds of aquatic vegetation.

Remarks

Describe anything that may aid in identification of the fishes, such as peculiar markings, habits, or habitats.

CHARACTERS USED IN IDENTIFYING SPECIES

A juvenile salmon is shown in Figure 1 to assist in recognizing and defining the characters and the counts and measurements used when keying out a specimen.

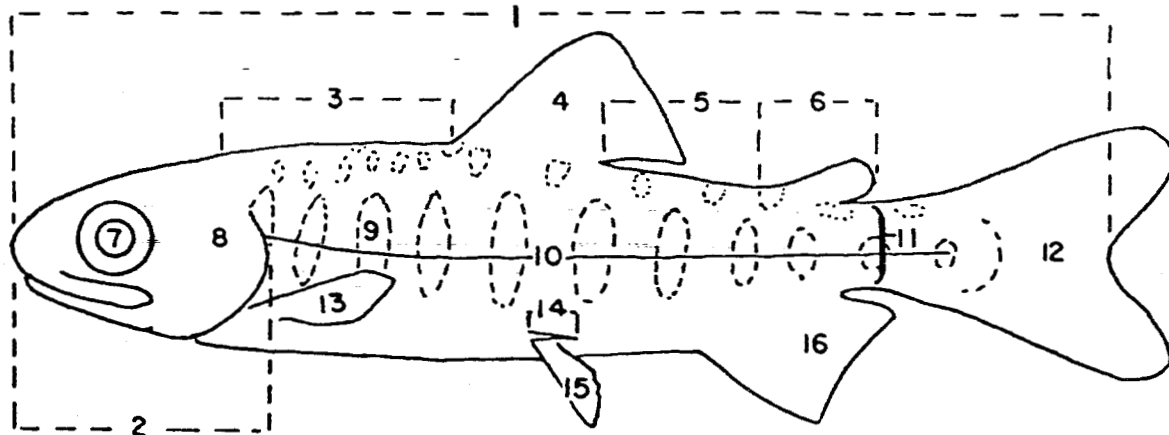
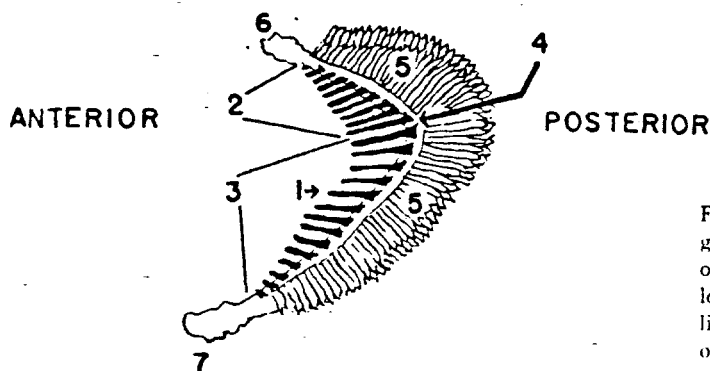


Figure 1.—Juvenile salmon, illustrating parts and methods of measuring: 1) fork length; 2) head length; 3) predorsal ridge; 4) dorsal fin; 5) portion of postdorsal ridge between posterior end of dorsal fin base and origin of adipose fin; 6) adipose fin; 7) pupil of eye; 8) gill cover, beneath which is gill chamber containing gill arches; 9) a parr mark; 10) lateral line; 11) caudal peduncle; 12) caudal fin or tail; 13) pectoral fin; 14) axillary process or scale; 15) pelvic fin; 16) anal fin.

FIRST GILL ARCH

Beneath each gill cover are four fully formed gill arches; the first gill arch on either side is the part used for specific identification. A gill arch (Fig. 2) consists primarily of a bony central arch to which the gill rakers are attached anteriorly, the gill filaments (lamellae) posteriorly. The gill rakers prevent solid substances such as food from being carried out through the branchial clefts and protect the delicate gill filaments. The numbers of gill rakers vary somewhat among individuals of each species of salmon, but the difference in average number between some species is sufficiently great to enable one to use them as specific characters.

The rakers on the gill arch may be counted as a unit, or the upper and lower limbs may be counted separately. The two limbs are joined



at an angle, the upper being the shorter. When a raker is situated astride the angle, it is included in the lower limb count. When all of the rakers on the arch are counted as a unit, a single number is given; otherwise, both limbs are recorded separately (the upper limb first), and then added, thus $12 + 20 = 32$.

The gill rakers nearest the angle of the arch are the longest; the rakers become progressively shorter as they approach the attachment ends of each arch. The rakers near the ends are often rudimentary and can be counted only under magnification.

It may be difficult to count all of the rakers accurately while the first gill arch is in place, in which case it will be necessary to remove the arch. To do this, turn back or cut away gill cover as shown in Figure 3. Lift the first gill arch up-

ward. With a sharp scalpel, cut between the dorsal ends of the first and second arches, making a deep incision parallel with them; then cut the remainder of the attachment away. Next cut the ventral attachment in the same manner; and when both ends are free, remove the arch. Great care must be taken so that all rudimentary rakers may be removed and counted. After finishing the examination of the arch, reinsert it in the gill chamber for possible future examination.

Gill Raker and Eye Comparison

The longest rakers are compared with the length of the eye (Fig. 4). With dividers, obtain the measurement of the length of the longest raker; then place one point of the dividers at the anterior edge of the eye, the other extending

Figure 2.—First gill arch of salmon after removal from left gill chamber: 1) gill raker; 2) gill rakers attached to upper or shorter limb of arch; 3) gill rakers attached to lower or longer limb of arch; 4) angle of arch (junction of the two limbs or bones); 5) gill filaments (lamellae); 6) upper point of arch attachment; 7) lower point of arch attachment.

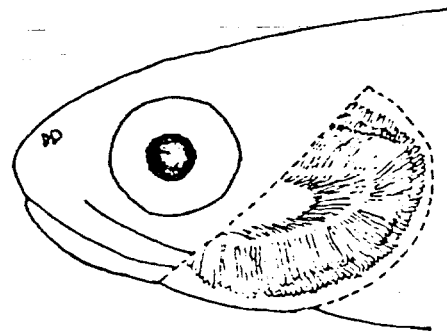
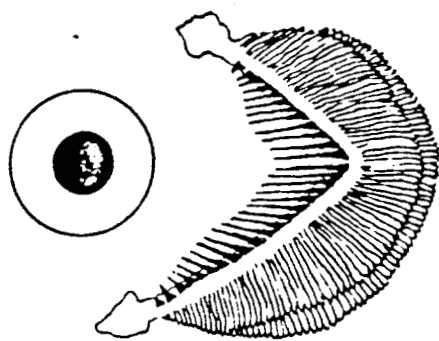
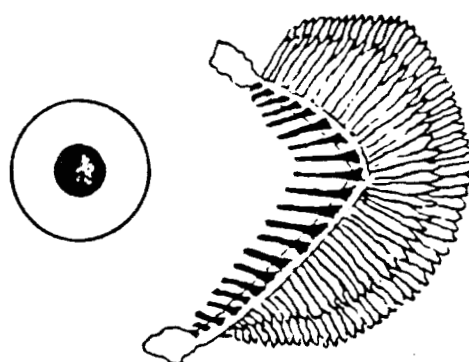


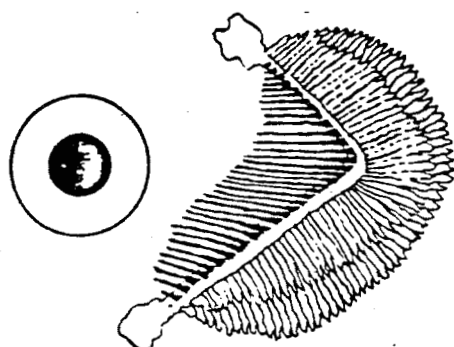
Figure 3.—Head of salmon. Dotted lines indicate that portion of gill cover which has been removed to show first gill arch in place.



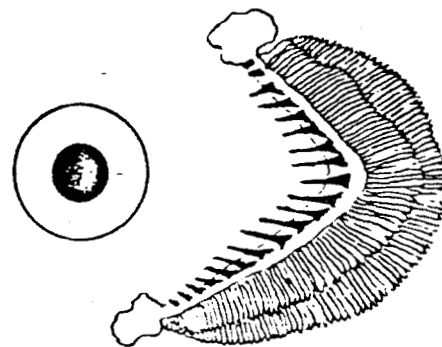
PINK



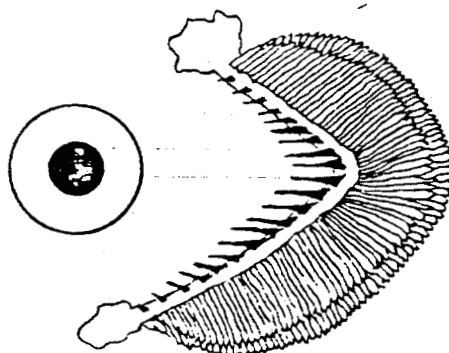
CHUM



SOCKEYE



CHINOOK



COHO

Figure 4. — First gill arch and eye for comparison with longest gill raker length of five species of Pacific salmon.

toward the opposite edge. Because the raker is shorter than the eye length in juvenile salmon, it is simplest to note where the raker reaches in relation to the pupil. Like many body part ratios, the gill raker-eye size ratios change as the juvenile salmon increases in length. For example, in specimens about 40 mm FL, the longest raker may be contained about 3 times the eye length, but in 140 mm specimens of the same species, the raker may be contained only about 2 times. This and other proportional changes must be considered.

Anal Fin Measurement and Count

To compare the length of the fin base with the longest ray, measure the anal fin base with dividers; then project the posterior leg of the dividers forward to the opposite tip of the longest ray as shown in Figure 5 by dotted line.

In counting the number of rays (Fig. 5), do not count those anteriormost ones which are less than half the length of the longest rays, such as those marked "0." Count all rays, such as No. 1, that are half (or more than half) the length of the longest ray, taking great care to observe the last ray—No. 15 in Figure 5. The last ray is usually split to its base and appears superficially as two rays, but it is in reality only one and should be counted as such.

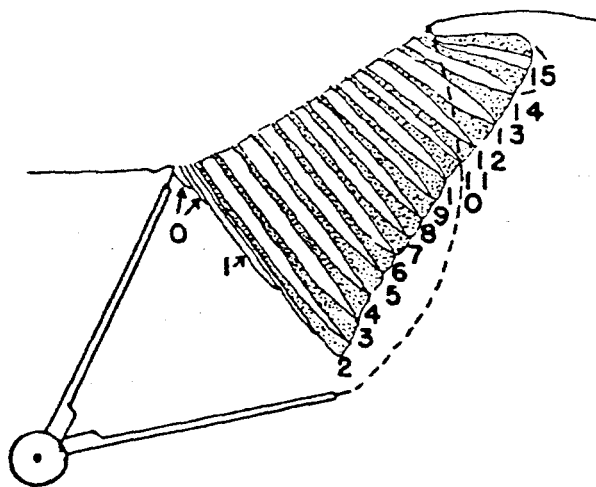


Figure 5.—Anal fin of salmon, illustrating method of measuring length of fin base and of counting rays (rays 2 to 15 are stippled here for emphasis).

Branchiostegal Count

All branchiostegals (Fig. 6), including the smallest, anteriormost ones are counted. Usually this may be accomplished satisfactorily only under magnification and with juveniles longer than 40 mm FL. The branchiostegal count is used primarily as an additional character in specimens otherwise difficult to identify, and is especially valuable in separating the chinook salmon (usually 15 or 16) from the coho salmon (usually 13 or 14).

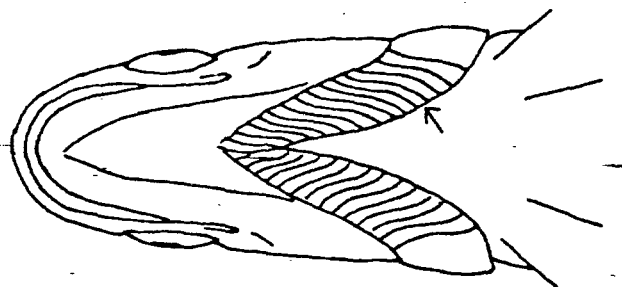


Figure 6.—Ventral surface of head of salmon. Arrow points to one of 14 branchiostegals on left side of head.

Pyloric Caeca Count⁴

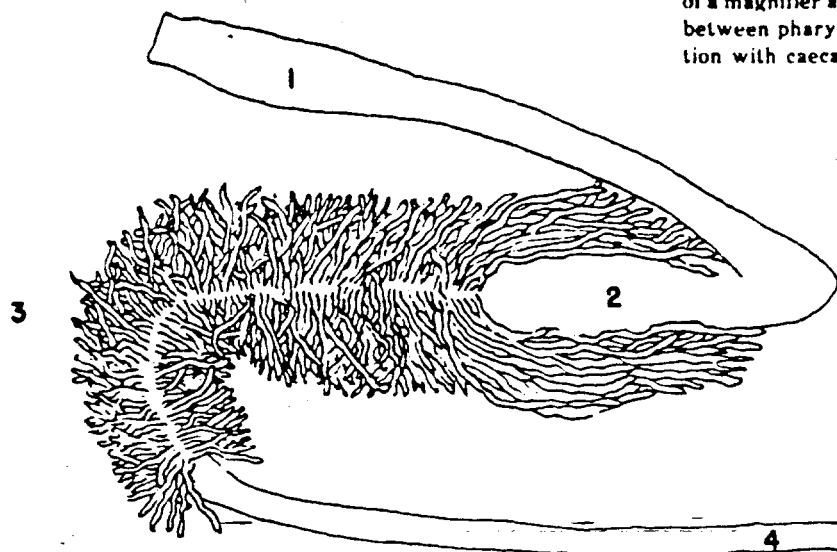
With a scalpel, widely open the abdominal cavity. Sever the esophagus as far forward as possible; then cut off the intestine near the posterior end of the stomach. The stomach and caeca can now be removed as a unit (Fig. 7). Use magnification and teasing needle as aids in counting. Counts of pyloric caeca are useful chiefly as an additional character for questionable specimens, especially in separating the chinook salmon (more than 100 caeca) from the coho salmon (fewer than 90).

Color Pattern Variations

Juvenile salmon from certain waters or at certain stages of development may have their parr marks or other markings masked by a bluish-

⁴In the key, I have used pyloric caeca counts of my own, plus published accounts of others and especially the more recent ones, such as Clemens and Wilby (1961) and McPhail and Lindsey (1970).

pyloric caeca spread apart preparatory to counting with aid of a magnifier and teasing needle: 1) esophagus (part of tract between pharynx and stomach), 2) stomach, 3) pyloric section with caeca, 4) intestine.



or greenish-silvery sheen, especially when they are alive. To identify these fish, it may be necessary to preserve them first in Formalin to intensify their markings.

Juveniles of one species from certain waters, such as habitually turbid ones, may have their melanophores restricted in size or distribution, thereby resembling superficially another species. As an example, coho salmon normally have the adipose and anal fins densely speckled with rather large melanophores. But in some specimens, the melanophores may be reduced in size or distribution, so that coho salmon superficially resemble chinook salmon. Conversely, juvenile chinook salmon may have the melanophores unusually numerous and well developed, thereby resembling coho salmon. To avoid error in identification, compare the size and number of melanophores on the fins with those on the body; if few and small on the body, they should be few and small on the fins.

Color variations also occur regionally. An example is the predorsal stripe in chinook salmon, which in fish from some waters is normally a solid dark bar in specimens less than 80 mm FL; in chinook salmon in other waters the stripe may be reduced to a series of oblong blotches.

The length when individuals attain smolt coloration varies greatly, both regionally and in specimens from the same locality; some fish of

the same species may lose parr and other presmolt markings when only half as large as other fish.

HOW TO USE KEY

Because of the variations in morphology and coloring, it is advisable to use the key in conjunction with the figures and plates and to check a large combination of characters.

In using the key, first make certain your specimen is a Pacific salmon by examining the characters under the two opposable groups labeled "1." Next, note the absence or presence of parr marks (see sections "*Combination of*" under opposable groups 2). If no parr marks are present and your specimen has not entered the silvery smolt stage, it is probably a pink salmon, but to make sure, compare it with the identifying characters between opposable groups 2. If parr marks are present, note the absence or presence of melanophores on adipose and anal fins (see groups 3). If melanophores are absent, see sections "*Combination of*" under groups 4; if present, see "*Combination of*" sections under groups 5. Decide which "*Combination of*" most closely fits your specimen, then verify it by comparing the descriptions of the identifying characters for the opposable groups.

KEY TO PRESMOLT JUVENILE SALMON

- Salmonoid fishes having fewer than 20 rays in the dorsal fin (excludes grayling); strong teeth on jaws and tongue (excludes ciscoes and whitefishes); many pyloric caeca (excludes smelts, family Osmeridae); an axillary process or scaly appendage above pelvic fin (Fig. 1, No. 14); an adipose fin; cycloid scales; upper jaw formed by both premaxillary and maxillary1.
- 1a Base of anal fin *shorter* than longest ray (Fig. 5). Anal rays usually 9 to 12 (rarely 8 or 13). Gill rakers normally fewer than 20 on first gill arch (Fig. 3). Dorsal fin of larger juveniles of some species with several blackish spots.
CHAR. TROUTS, ATLANTIC SALMON.Not in this key.
- 1b Base of anal fin *longer* than longest ray (Fig. 5). Anal rays usually 13 to 17 (rarely 12, 18, or 19). Gill rakers normally 20 to 40 on first gill arch (rarely 19). Dorsal fin of larger juveniles lack blackish spots but tip of fin may be blackish.
PACIFIC SALMON—genus *Oncorhynchus*.2.
- 2a *Combination of:* No parr marks on sides and no prominent specklings on back of presmolt juveniles. Usually no melanophores on anal and adipose fins; if melanophores present, they are few and very small, and if on adipose, are restricted to its posterior, free edge.
PINK (HUMPBACK) SALMON—*O. gorbuscha*.Plate 1.
- General development—Similar to chum salmon in that yolk sac may not disappear until juvenile is more than 34 mm FL, after which development toward smolt shape and coloration is rapid. When less than 50 mm FL, this species is similar to chum salmon in being more terete than the sockeye, chinook, and coho salmon; body depth immediately before dorsal fin usually more than 1.5 times head length.
- Parr marks—Only species of salmon lacking parr marks in the presmolt juvenile.
- Coloration of body—*Preserved material*—In juveniles less than 40 mm FL, back is dark to lateral line and ventral half of body light when bicolored; dorsal third of body is darkest, sides lighter, ventral third lightest (usually milky-white or silvery) when tricolored. Few or no melanophores on lower sides and belly. In juveniles more than 40 mm FL, bicolored or tricolored condition is normally not evident, the dark back lightening gradually downward to the very light belly. *Living specimens*—Dorsal half of body bright bluish or greenish with much silvery reflection; ventral half milky or silvery-white.
- Fins—Anal and dorsal fins averaging smaller than in chum salmon; these fins in this species and in chum salmon distinctly smaller than in sockeye, chinook, or coho salmon. In specimens less than 40 mm FL the longest anal ray, when measured into head length, extends from tip of snout to about center of eye; in larger presmolt juveniles, this measurement extends from tip of snout to anterior half of eye. Anal rays usually 14 to 16 (extremes 13 to 17). *Dorsal fin* has few specklings and only a slight tendency toward a dark anterior edge in juveniles less than 50 mm FL; over 50 mm, blackish anterior edge becomes pronounced and tip of fin dusky. *Caudal fin* has speckling confined to basal half in juveniles less than 50 mm; with increasing length of juveniles, specklings appear along rays, and in large presmolt juveniles lobes tend to become blackish.

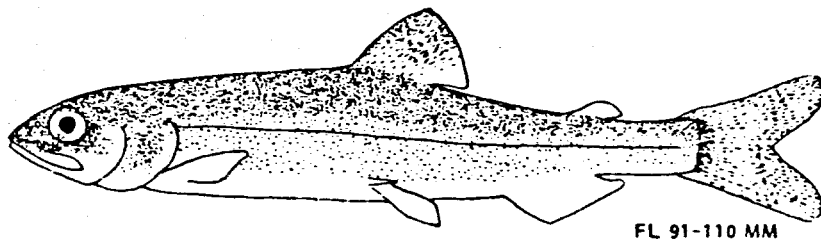
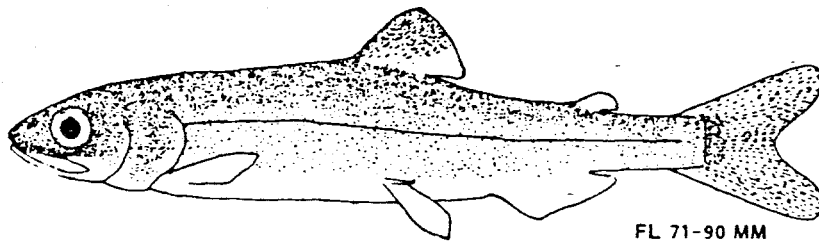
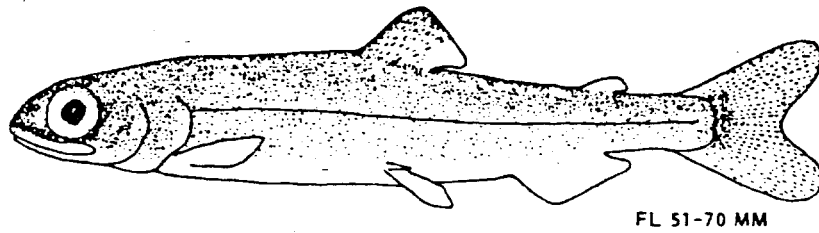
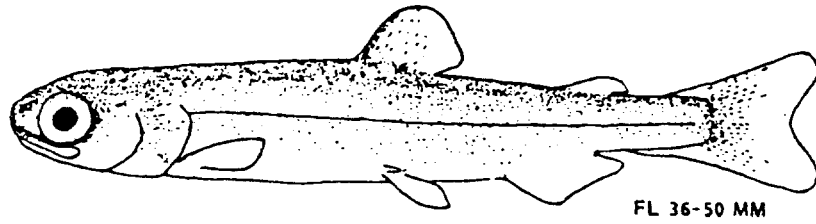
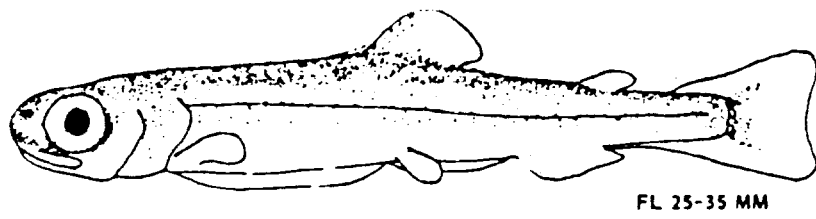


Plate 1.—Pink salmon.

Gill rakers (see Fig. 4) — Eleven to fourteen on upper limb, 14 to 19 on lower, total usually ranging between 27 and 33 (extremes 25 and 35); rakers slender and rather long; most similar in size and number to sockeye salmon but shorter and usually fewer (normally less than 31).

Pyloric caeca — Usually 130 to 195 (extremes 95 to 224); slender and rather long; differ sufficiently in numbers from coho and sockeye salmon, which have fewer than 100, to be a distinct aid in specific identification.

Branchiostegal rays — Usually 11 to 14 (rarely 10 or 15); average number less than in other species, almost invariably less than in chinook salmon, which usually has 15 to 18 (rarely 14).

Scales in lateral line — More than 170, more than in any other of the Pacific salmon; lateral line scale counts may be obtained under magnification in specimens longer than 60 mm FL.

Habits — Shortest life span of any species, between 18 mo and 2 yr. Only a comparatively small proportion of adults make extended migration in fresh water. Majority spawn in fresh waters within a short distance of brackish water or in intertidal waters. Many young enter brackish or salt waters within a few hours or days after emerging from redds, and comparatively few are found in fresh water when more than 45 mm FL.

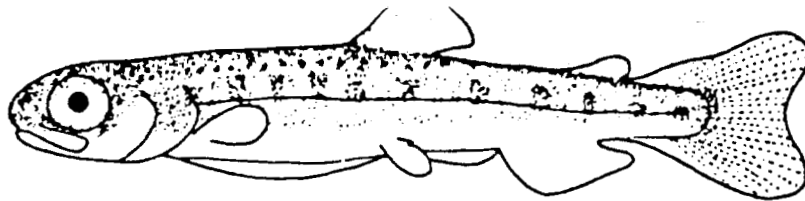
2b *Combination of:* Both parr marks on sides and dark spottings on back usually obvious in living, presmolt juveniles and always in preserved specimens under magnification (may be faint in fishes from turbid waters); parr marks become faint and disappear as juvenile assumes smolt coloration 3.

3a No melanophores normally present on adipose and anal fins of presmolt juveniles, or if present, few and quite small. Parr marks occupy a larger area above lateral line than below it, and in some specimens anterior parr marks may be almost entirely above the lateral line.
CHUM AND SOCKEYE SALMON 4.

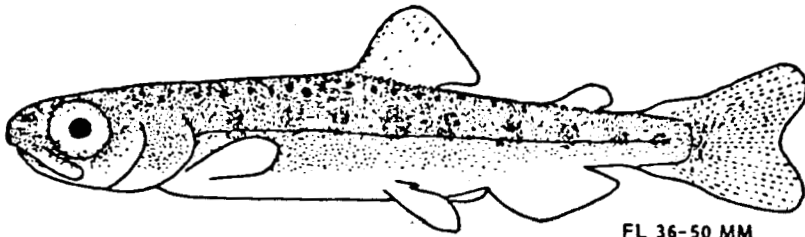
3b Melanophores normally obvious on adipose fin in living specimens and always in preserved specimens under magnification (may be indistinct in juveniles from silty waters). Anteriormost parr marks appear to occupy as large (or almost as large) an area below lateral line as above it; these parr marks are usually large, long, and wide.
CHINOOK AND COHO SALMON 5.

4a *Combination of:* Gill rakers 19 to 26 (average 23), notably fewer and much shorter than in sockeye salmon, which have more than 28. Normally no melanophores on adipose and anal fins. Anterior squarish (quadrate) parr marks situated almost or entirely above lateral line in specimens less than 50 mm FL; in presmolt juveniles more than 50 mm FL, anterior parr marks tend to be long and very narrow and sometimes may extend well below lateral line.
CHUM (DOG) SALMON — *O. keta* Plate 2.

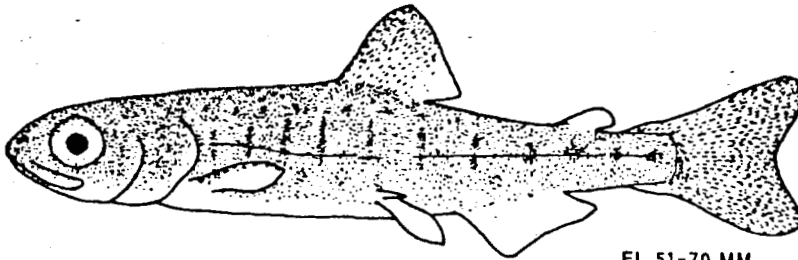
General development — Similar to pink salmon in that yolk sac may not disappear until juvenile is more than 34 mm FL, after which development toward smolt shape is rapid. Also similar to pink salmon in being more terete (when less than 50 mm FL) than the sockeye, chinook, and coho salmon; body depth immediately before dorsal fin usually 1.5 to 1.8 times head length.



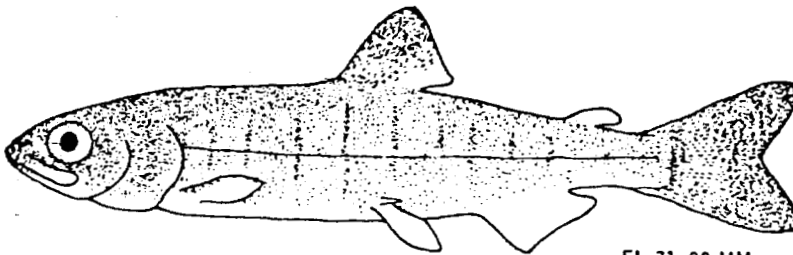
FL 25-35 MM



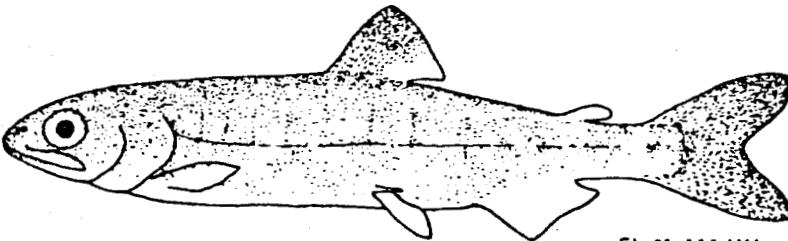
FL 36-50 MM



FL 51-70 MM



FL 71-90 MM



FL 91-110 MM

Plate 2. — Chum salmon.

Parr marks—Anterior parr marks in specimens less than 50 mm FL are more squarish-(quadrate) and do not extend quite so far below lateral line as in sockeye salmon; in presmolt juveniles more than 50 mm FL, parr marks tend to become longer and more narrow than in sockeye salmon, and some tend to extend well below lateral line.

Coloration of body—*Preserved material*—Dorsal ridge stripe usually present, sometimes a series of blotches in juveniles less than 50 mm FL, becoming faint or disappearing in presmolt juveniles more than 50 mm FL; a prominent irregular row of spots and blotchings between dorsal ridge and upper edge of parr marks, these usually most distinct in specimens between 34 and 50 mm, often fading or disappearing in larger juveniles. *Living specimens*—Markings may be obscured by greenish or bluish overcast of dorsal half of body and whitish or silverish sheen of ventral half.

Fins—Anal and dorsal fins small, averaging slightly larger in size than those of pink salmon and averaging considerably smaller in height and area than those of sockeye salmon. Length of longest anal ray, when measured from snout to eye, reaches to, or almost to, center of eye; in sockeye salmon this measurement usually extends well beyond center of eye. Anal rays usually 13 or 14 (extremes 13 to 17). *Dorsal fin* has few or no distinct spottings in specimens less than 50 mm FL; in larger presmolt juveniles a dusky spot develops on tip. *Caudal fin* has faint spots largely confined to basal half in juveniles less than 50 mm FL; in larger juveniles lobes become blackish.

Gill rakers (see Fig. 4)—Seven to twelve on upper limb, 12 to 19 on lower, total usually ranging between 20 and 26 (extremes 19 to 30); rakers blunt and short, in sharp contrast to thinner, longer, and more numerous rakers of sockeye salmon, which has 30 to 39.

Pyloric caeca—Usually 160 to 185 (extremes 140 to 249); differ sufficiently in numbers from sockeye and coho salmon, which usually have fewer than 100, to be an aid in specific identification.

Branchiostegal rays—Usually 13 or 14 (extremes 12 to 16); of value primarily in separating this species from chinook salmon, which generally has more than 15.

Scales in lateral line—Between 125 and 155; of value chiefly in separating this species from pink salmon.

Habits—Life span usually 3 to 5 yr, for majority, 4 yr, some less than 3 yr. Jacks may occur. Majority spawn in fresh waters only a comparatively short distance from brackish water or in intertidal waters. Many young enter brackish or salt waters very shortly after emerging from redd, and few juveniles are found in fresh waters when more than 45 mm FL.

Combination of: Gill rakers 30 to 39 (average 36); notably more numerous, longer, and more slender than in chum salmon, which have fewer than 27. Normally no melanophores on adipose and anal fins. Anterior parr marks more rectangular than squarish in outline in specimens less than 45 mm FL and sometimes extend as much as a third to a half below lateral line; these oblong parr marks tend to shorten in presmolt juveniles more than 50 mm FL and to be mostly above lateral line.

4b

SOCKEYE (RED) SALMON—*O. nerka*. Plate 3.

General development—Yolk sac usually disappears, except for trace, before juveniles reach 30 mm FL. Body deeper and species more slab-sided in all presmolt lengths than in chum and pink salmon—body depth immediately before dorsal fin usually less than 1.5 times head length.

Parr marks—See "Combination of" above.

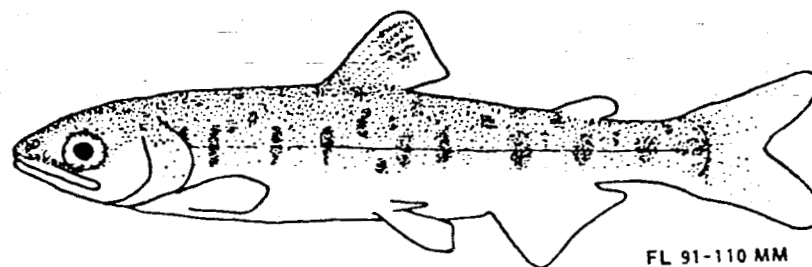
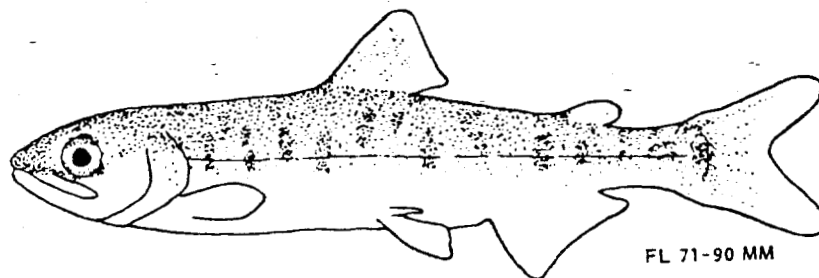
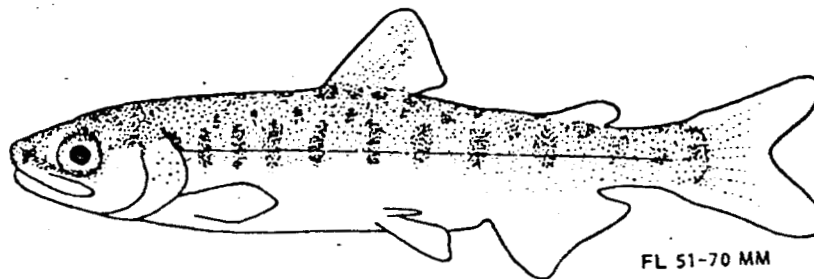
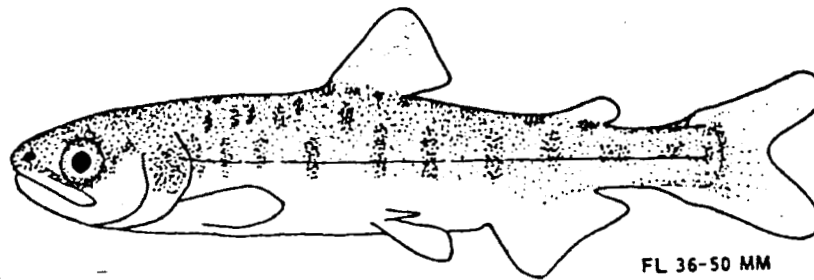
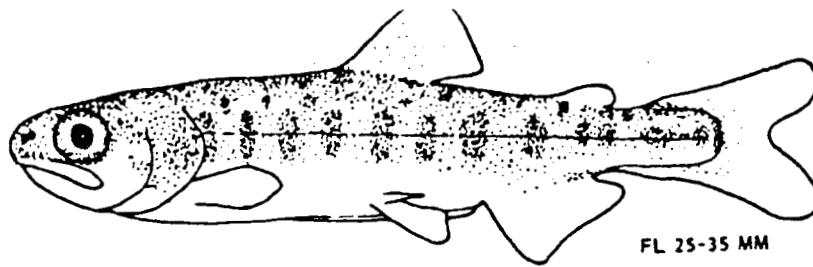


Plate 3.—Sockeye salmon.

Coloration of body—*Preserved material*—Dorsal ridge usually contains a series of more or less distinct spots in specimens less than 35 mm FL, becoming more confluent in fishes between 40 and 55 mm FL and sometimes merging into a dusky bar; in presmolt juveniles over 60 mm FL, spots or bars may disappear, after which a series of roundish spots become apparent on both sides of, and adjacent to, dorsal ridge, especially that portion behind dorsal fin; in addition to these spots, in fishes more than 35 mm FL, another longitudinal row of spots develops between dorsal ridge and upper halves of parr marks. *Living specimens*—Markings may be obscured by greenish or bluish overcast of dorsal half of body and whitish or silverish sheen of ventral half.

Fins—Anal and dorsal fins average larger in height and area than in chum and pink salmon. Length of longest anal ray, when measured from snout to eye, reaches usually from snout to beyond center of eye. Anal rays usually 14 to 16 (extremes 13 to 16). *Dorsal fin* normally has few or no distinct specklings in specimens less than 60 mm FL; a rather faint dorsal spot develops in larger presmolt juveniles in upper portion of fin, the fin being bordered on its free edges with whitish (see lowest figure, Plate 3). *Caudal fin* has few specklings on basal half, the lobes having few or no melanophores, even in rather large juveniles.

Gill rakers (see Fig. 4)—Twelve to sixteen on upper limb, 18 to 23 on lower, total usually ranging between 32 and 37 (extremes 30 to 39); rakers long and slender, averaging longer than in any other species, in sharp contrast to fewer, blunter rakers of chum salmon, which has 19 to 30.

Pyloric caeca—Usually 65 to 95 (extremes 45 to 115); usually considerably fewer than in pink, chum, and chinook salmon, and averaging more than in coho salmon.

Branchiostegal rays—Usually 13 to 15 (extremes 11 to 16); of value chiefly in separating this species from chinook salmon, which average more.

Scales in lateral line—Between 125 and 140; of value chiefly in separating this species from pink salmon, which has a higher number.

Habits—Life span usually 4 or 5 yr. some only 3. Jacks may occur. Majority of individuals highly migratory. Adults usually spawn in streams tributary to lakes; a small minority spawn in streams without a lake, in lake outlets, or on lake beaches. After rising from redd, young move downstream rather rapidly to a lake, remaining usually 1, sometimes 2, and rarely 3 yr in fresh water before entering brackish or salt water.

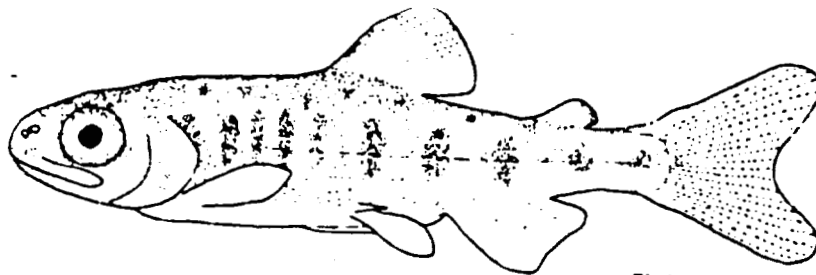
Combination of: Melanophores on adipose fin usually most numerous on posterior half and generally forming a dark border (see Plate 4); anterior half of adipose with few melanophores or none. Anal fin with few melanophores or none, but when melanophores are present, often quite large. Tip of dorsal fin and lobes of caudal fin darker in larger presmolt juveniles.

5a

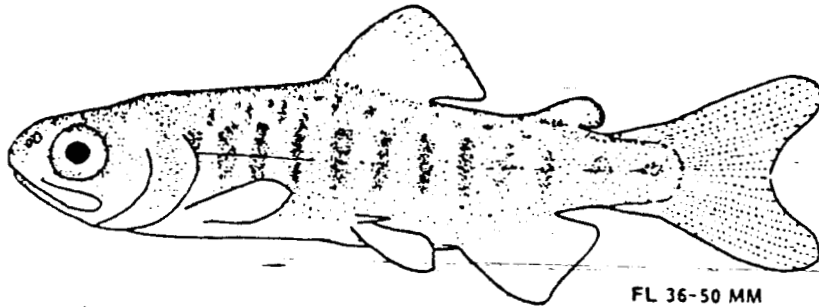
CHINOOK (KING) SALMON—*O. tshawytscha*. Plate 4.

General development—Yolk sac usually disappears or is reduced to a trace before juveniles reach 32 mm FL. Body deeper and species more slab-sided in all presmolt lengths than in chum and pink salmon; body depth immediately before dorsal fin usually less than 1.5 times head length (range 1.1 to 1.5).

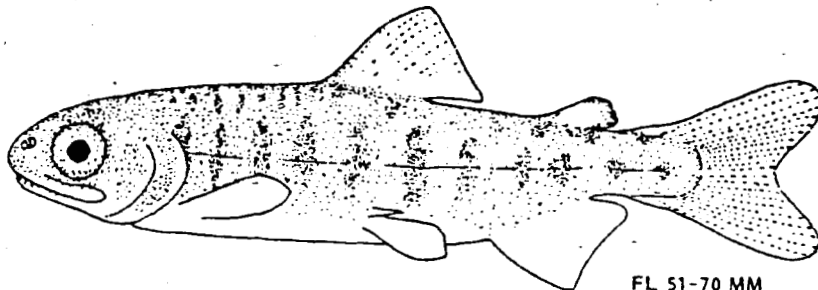
Parr marks—Almost invariably rectangular and long vertically; marks usually situated equidistant on each side of lateral line; dark parr marks and other markings contrast sharply with lighter background of body in some living and most preserved specimens.



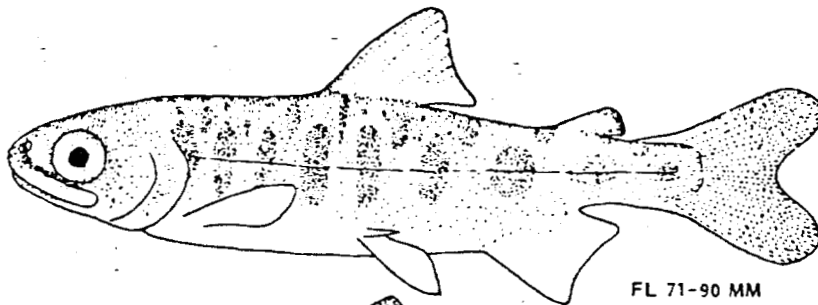
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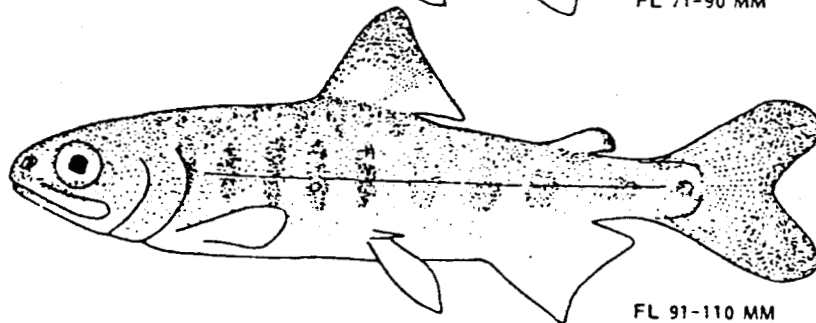
FL 36-50 MM



FL 51-70 MM



FL 71-90 MM



FL 91-110 MM

Plate 4.—Chinook salmon.

Coloration of body—*Preserved material*—Background color of body generally much lighter than body color of coho salmon, usually contrasting sharply with dark dorsal stripe or spotting, parr marks, and prominent dorsal spottings; blackish band astride dorsal ridge usually bold and unbroken in specimens less than 80 mm FL and especially on ridge before dorsal fin; in larger juveniles dorsal band often breaks up into series of spots, disappearing in larger pre-smolts as other spottings on dorsal half of body become more numerous and distinct; spottings between dorsal ridge and parr marks absent in fishes less than 35 mm FL, developing rapidly thereafter into many large and small spots and increasing in numbers as juveniles approach smolt stage. *Living specimens*—Parr marks and other markings may be obscured by bluish-silvery color of dorsal half of body and silvery sheen of ventral half.

Fins—Anal and dorsal fins averaging considerably larger in area than those of the chum and pink salmon and slightly larger than in the sockeye salmon; length of longest anal rays, when measured into head length, reaching from snout tip to beyond posterior edge of pupil and sometimes beyond posterior edge of eye; distal edge of anal slightly falcate in specimens more than 40 mm FL but averaging less falcate than does the free edge of the anal of the coho salmon. Anal rays 15 to 19, averaging higher in number than in any other species. *Dorsal fin* in young less than 60 mm FL usually has few or no distinct spottings; a blackish spot developing in the upper portion of the fin as the juveniles approach the smolt stage (see Plate 4). *Caudal fin* has comparatively few melanophores rather generally distributed in the smaller individuals, the lobes darkening as the fishes approach the presmolt stage.

Gill rakers (see Fig. 4)—Seven to twelve on upper limb, 10 to 16 on lower, total usually ranging between 20 and 25 (extremes 19 to 28); rakers short and similar in size and number to chum and coho salmon.

Pyloric caeca—Usually 140 to 185 (extremes 90 to 240); of value in separating this species from coho salmon, which normally has fewer than 85.

Branchiostegal rays—Usually 16 to 18 (extremes 13 to 19); average number greater than in any other species.

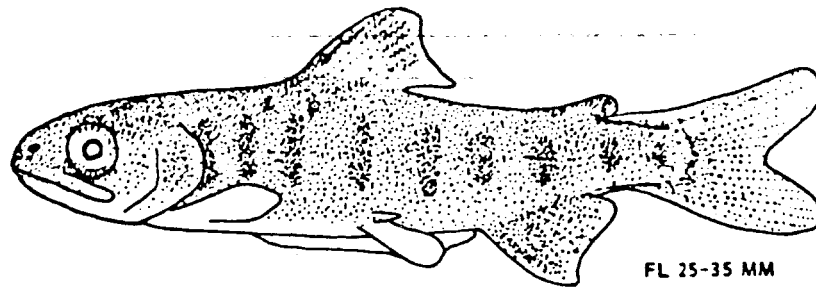
Scales in lateral line—Between 132 and 152; usually of most value in separating this species from pink salmon.

Habits—Life span 2 to 8 yr, usually 4 to 6. Jacks may occur. A portion of the juveniles enter salt water during first year of life; remainder stay in fresh waters more than 1 yr but rarely 2 yr. Juveniles of presmolt stage found in fresh waters when as long as 150 mm FL.

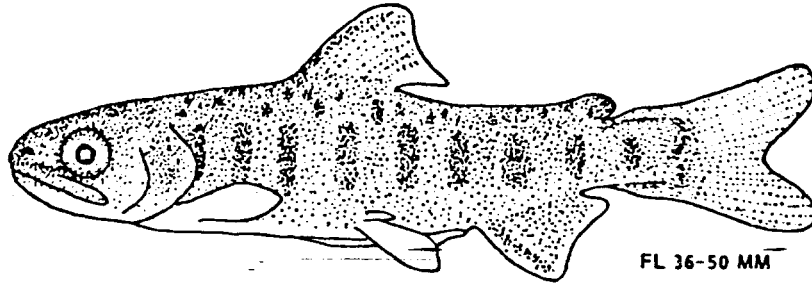
Combination of: Melanophores usually numerous and rather evenly distributed on adipose fin; occasionally in larger juveniles, posterior or free edge may be darker than remainder, thereby resembling somewhat melanophore distribution on adipose of chinook salmon. Anal fin in specimens larger than 30 mm FL more falcate and anterior tip more pronounced than in other species, including chinook salmon; in all except smallest specimens, anterior or leading edge of anal fin is whitish, with a dark bar parallel and posterior to it; remaining, posterior portion of fin usually abundantly speckled with melanophores except for distal and posterior edges (see Plate 5).

COHO (SILVER) SALMON—*O. kisutch*. Plate 5.

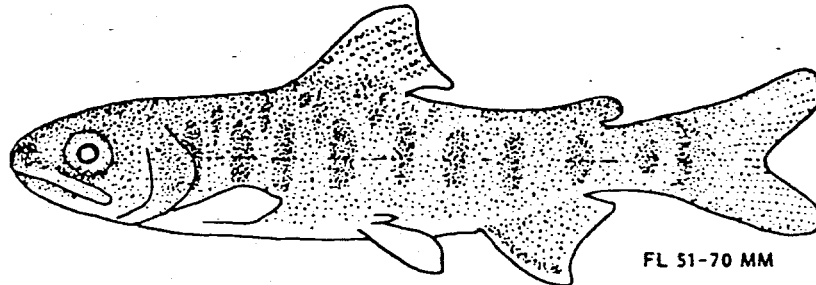
General development—Yolk sac usually disappears, except for a trace, before juveniles reach 32 mm FL. Body deeper and species more slab-sided in all pre-



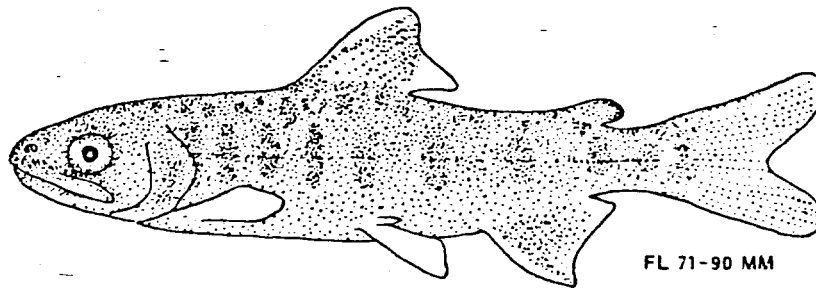
FL 25-35 MM



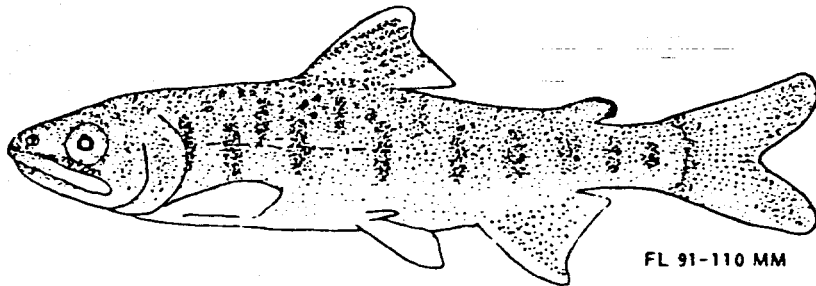
FL 36-50 MM



FL 51-70 MM



FL 71-90 MM



FL 91-110 MM

Plate 5. — Coho salmon.

smolt lengths than in chum and pink salmon; body depth immediately before dorsal fin usually less than 1.5 times head length (range 0.9 to 1.5).

Parr marks—Anterior parr marks always large and long vertically, their upper and lower ends more rounded than rectangular-shaped parr marks of chinook salmon; marks usually situated equidistant on each side of lateral line; usually less contrast between color of parr marks and body than in chinook salmon.

Coloration of body—*Preserved material*—In all but smallest specimens, contrast between all body marks and background color of body is not as pronounced as in other species; dark bar along dorsal ridge usually distinct and unbroken in juveniles less than 50 mm FL, breaking up into spots or disappearing in larger specimens; back spottings on both sides of dorsal ridge usually prominent in all except smallest specimens; spots between parr marks often elongate and extending downward between them, sometimes to lateral line (see bottom figure, Plate 5); spots on dorsal half of body often increase in number and/or decrease in size as individuals approach smolt stage. *Living specimens*—Parr marks and other body markings may be obscured by dark coloration of body or by bluish sheen.

Fins—Anal and adipose fins described under "Combination of" (this section). Anal rays usually 13 or 14 (extremes 13 to 16). Dorsal fin has comparatively few melanophores scattered over it in smallest specimens; in those more than 32 mm FL the number of melanophores increases, especially on or adjacent to anterior or leading edge; this results in a dark bar along the anterior edge behind which melanophores are rather evenly distributed; as fishes approach presmolt stage, a white anterior (or leading) edge and a whitish tip develops, followed by a dark parallel bar (see bottom figure, Plate 5). Caudal fin has rather even distribution of melanophores along rays in all except smallest young, this increasing in color intensity and number as fish increases in size.

Gill rakers (see Fig. 4)—Eight to thirteen on upper limb, 9 to 14 on lower, total number usually ranging between 19 and 27 (extremes 18 to 27); rakers short and rather similar in size and number to chum and chinook salmon.

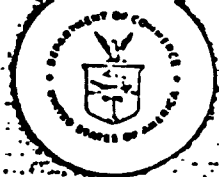
Pyloric caeca—Usually 50 to 85 (extremes 45 to 114); of value in separating this species from chinook, pink, and chum salmon, which normally have more than 100.

Branchiostegal rays—Usually 13 or 14 (extremes 12 to 15); average number less than in chinook salmon, which normally has 15 or more.

Scales in lateral line—Between 120 and 140 (average 128); usually averaging fewer than in any other species.

Habits—Life span 2 to 4 yr. Jacks may occur. Majority appear to spend 1 or 2 yr in fresh waters, a few 3 yr. Some juveniles in presmolt stage are found in fresh waters when 150 mm FL.

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Key to Field Identification of Anadromous Juvenile Salmonids in the Pacific Northwest

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SEATTLE, WA.
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ABSTRACT

A key is presented with descriptive illustrations to help in field identification of live, juvenile salmonids in fresh waters of the Pacific Northwest. Other juvenile fish that may be mistakenly identified as salmonids are included.

INTRODUCTION

Species identification of live, anadromous juvenile salmonids is frequently a problem to the field biologist. The purpose of this key is to list and illustrate the external characteristics which will expedite field identification of juvenile salmonids in the Pacific Northwest.

Five species of Pacific salmon (pink, chum, sockeye, chinook, and coho); four species of trout (cutthroat, brown, Dolly Varden, and rainbow or steelhead); and other juvenile and adult fish¹ that may be mistaken for salmon or trout in fresh water are described in this key.

USE OF KEY

The characteristics for identification are listed in a series of alternative statements, some of which are illustrated. To use the key, examine the first statement; if applicable, proceed to the next and continue to successive statements until the species is identified. If a statement is not applicable, pass to the alter-

native characteristics indicated by numbers in parentheses (numbers on the drawings correspond to numbers of statements in the key). Continue in this manner until the specimen is identified. Some external characteristics are positive separating features (marked with asterisk), whereas others are not. Therefore, two or more statements should be considered before final rejection. If a precise identification cannot be made using the external characteristics—and the fish can be sacrificed, a positive identification can usually be made from internal features (marked with double asterisks). A bibliography of keys that utilize more descriptive internal characteristics is included in this paper.

KEY

1. (47) Adipose fin and scales present.
(Fig. 1)
2. (48) Fleshy appendage at base of pelvic fins present.
3. (49) Mouth large, reaching at least to center of eye.

Family Salmonidae

¹ Especially adult smelt, family Osmeridae.

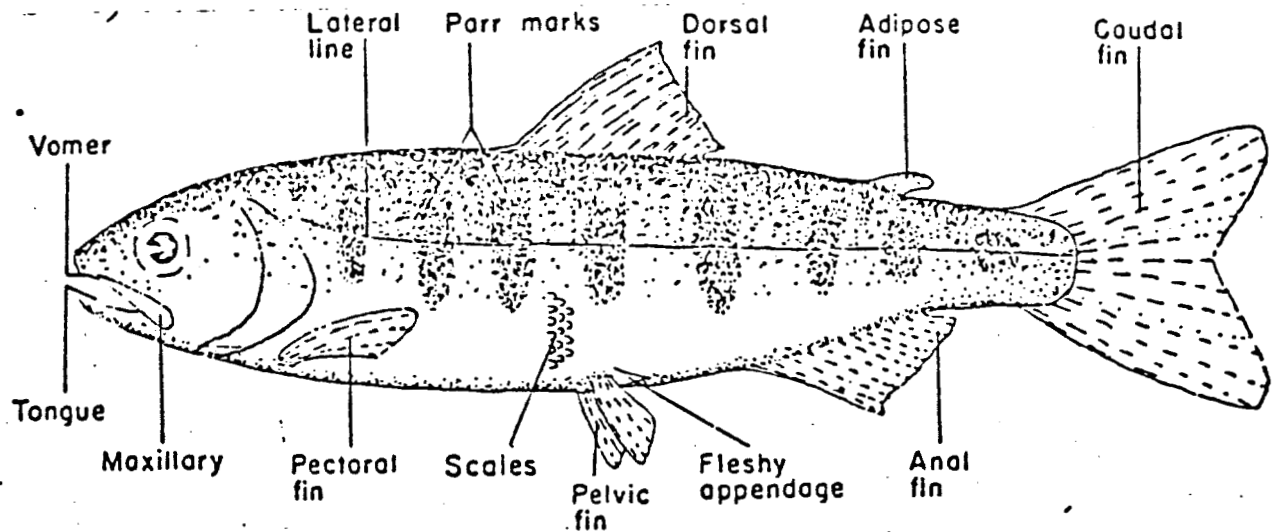


Figure 1.—A hypothetical salmonid showing external characteristics.

4. (17) Anal fin higher than long, with 8 to 12 developed rays (Fig. 2A)
5. (52) *Teeth on head and shaft of vomer. (Fig. 3A)

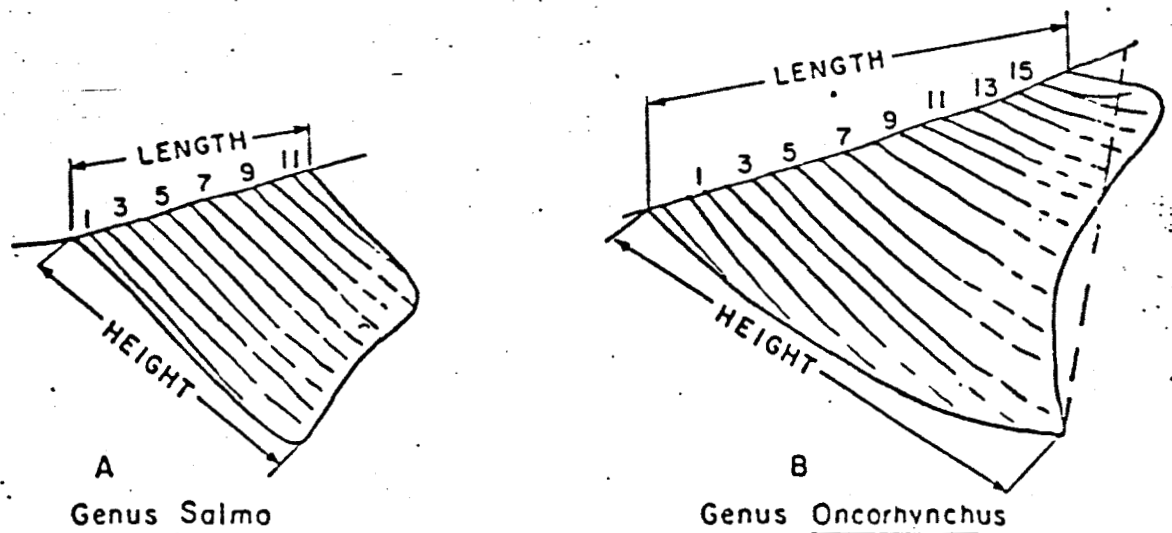
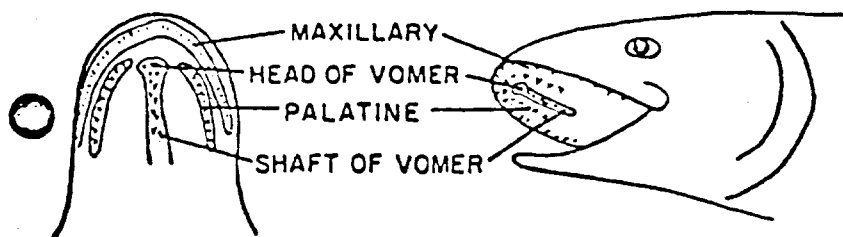
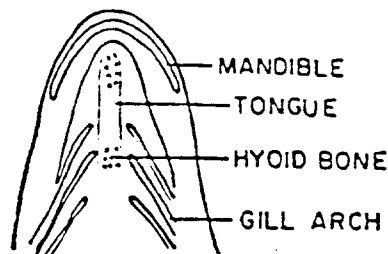


Figure 2.—Anal fins: (A) Trout, genus *Salmo*; (B) Pacific salmon, genus *Oncorhynchus*. The two drawings show differences in structure and fin ray count. (Note that the length of the anal fin is its overall basal length, and its height is that distance from the origin of the fin to the tip of the anterior lobe. In counting fin rays, include only those which originate from the base and terminate at the outer margin of the fin or are half as long as (or greater than) the longest ray.)



A



B

Figure 3.—Location of dentition in (A) the roof and (B) the floor of the mouth of salmonid fishes. (Presence or absence of teeth on the vomer or tongue may be determined by use of the little finger or a blunt instrument. The small hyoid teeth at the base of the tongue are located between the gill arches of the lower jaw and are difficult to find.)

6. (18) Dorsal fin with large dark spots.
Trout
Genus *Salmo*

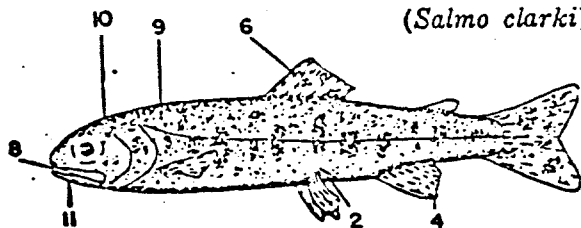
7. (53) Adipose fin not orange; no row of pale round spots along lateral line.
8. (12) *Small hyoid teeth at base of tongue. (Fig. 3B)

9. (13) Not more than five parr marks on mid-dorsal ahead of dorsal fin.

10. (14) Maxillary reaching past posterior margin of eye.

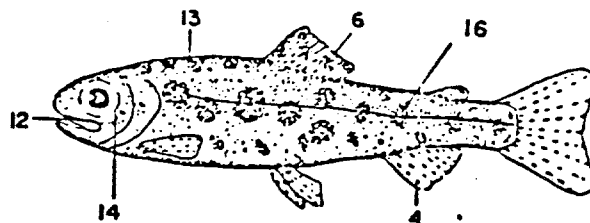
11. (15) Red or yellowish hyoid mark under lower jaw. Tail usually black spotted.

Cutthroat trout
(*Salmo clarki*)



16. (20) Parr marks almost round.

Rainbow or
steelhead trout
(*Salmo gairdneri*)



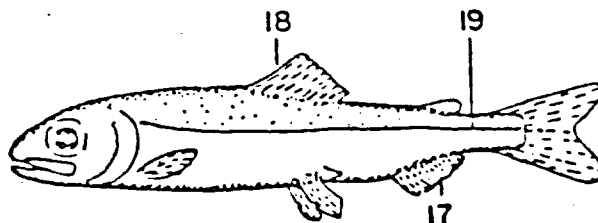
17. (4) Anal fin longer than high, with 13 or more developed rays. (Fig. 2B)

18. (6) Dorsal fin without large dark spots, may be black tipped.

Pacific salmon
Genus *Oncorhynchus*

19. (20) No parr marks. Fry leave fresh water while small—approximately 1.75 inches (45 mm) long.

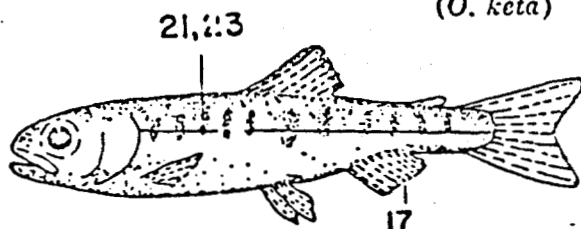
Pink salmon
(*O. gorbuscha*)



12. (8) *No teeth at base of tongue.
13. (9) Five to 10 parr marks along mid-dorsal ridge ahead of dorsal fin.
14. (10) Maxillary short, not reaching past posterior margin of eye.
15. (11) No hyoid mark under lower jaw. Few or no spots on tail.

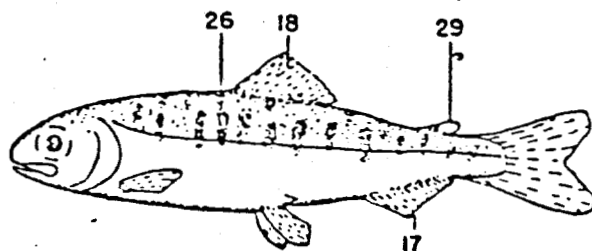
- 20. (16) Parr marks present as vertical bars or oval spots.
- 21. (30) Parr marks short, extending little, if any, below lateral line.
- 22. (25) Gill rakers on first arch, 19 to 26.
** Pyloric caeca, 140 to 186.
- 23. (26) Parr marks faint. Sides below lateral line iridescent green.
- 24. (27) Small when migrating from fresh water, approximately 1.5 inches (40 mm) long.

Chum salmon
(*O. keta*)



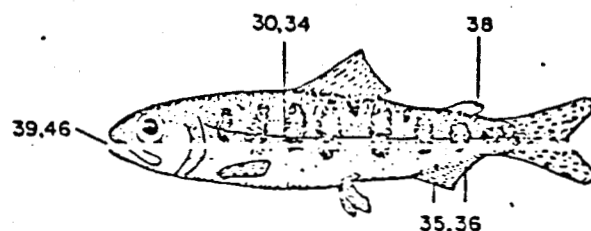
- 25. (22) Gill rakers on first arch, 30 to 40.
**Pyloric caeca 60 to 115.
- 26. (23) Parr marks usually sharply defined. Sides below lateral line silvery, not iridescent green.
- 27. (24) Relatively large when migrating from fresh water, approximately 3 to 5 inches (80 to 126 mm) long.
- 28. (31) Gill rakers long and slender, more than 29 on first arch.
- 29. (32) Adipose fin clear, not pigmented.

Sockeye salmon
(*O. nerka*)



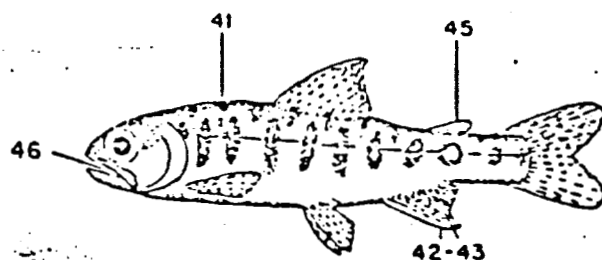
- 30. (21) Parr marks large, vertical bars centered by lateral line.
- 31. (28) **Gill rakers short and thick, fewer than 29 on first arch.
- 32. (29) Adipose fin at least partially pigmented.
- 33. (40) **Pyloric caeca more than 90.
- 34. (41) Parr marks broader than interspaces.
- 35. (42) Anterior rays of anal fin not distinctly longer than rest, not white edged.
- 36. (43) Anal fin not pigmented.
- 37. (44) Black spots, when present, on both lobes of caudal fin.
- 38. (45) Adipose fin not completely mottled, clear area at anterior base of fin.
- 39. (46) Black gums along base of lower teeth.

Chinook salmon
(*O. tshawytscha*)



- 40. (33) **Pyloric caeca less than 80.
- 41. (34) Parr marks narrower than interspaces.
- 42. (35) Anterior rays of anal fin elongated; when depressed they extend to base of last ray. (Fig. 2B)
- 43. (36) Anal fin pigmented between rays, resulting in black banding.
- 44. (37) Black spots, when present, on upper lobe of caudal.
- 45. (38) Adipose fin completely pigmented.
- 46. (36) Mouth gray to white.

Coho salmon
(*O. kisutch*)



47. (1) Adipose fin not present; scales present or lacking.

Not Salmonidae

48. (2) No fleshy appendage at base of pelvic fins.

Smelts

Family Osmeridae

49. (3) Mouth small, not reaching center of eye; teeth weak or absent.

50. (51) Depressed dorsal fin, shorter than head.

Whitefishes

Genus *Coregonus*

51. (50) Depressed dorsal fin, longer than head.

Arctic grayling

(*Thymallus arcticus*)

52. (5) **Teeth on head of vomer only.

Chars

Genus *Salvelinus*

Dolly Varden (*S. malma*)

53. (7) Adipose fin orange; row of distinct pale round spots along lateral line.

Brown trout

(*Salmo trutta*)

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FRAZER LAKE
1991 OPERATIONAL PLAN



Alaska Department of Fish and Game
Division of Commercial Fisheries
211 Mission Road
Kodiak, AK 99615

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INTRODUCTION

Frazer Lake is located on the Southern end of Kodiak Island and is the second largest lake within the Kodiak Archipelago (Figure 1). Frazer is 14.2 km long, 1.6 km wide, with a surface area of 16.1 km². Prior to 1951 Frazer Lake was void of sockeye salmon (*Oncorhynchus nerka*) owing to a 10 meter barrier falls prohibiting anadromous fish from entering the lake (Russell 1972). Egg, fry and adult transplants (1951-1971) from sockeye systems on Kodiak Island (Karluk and Red Lakes) and the Alaska Peninsula (Becharof Lake) established a sockeye salmon run with adults returning for the first time in 1956 (Russell 1972). From 1956-1961 returning adults were back-packed over the falls, and in 1962 a fishpass constructed to promote access to the lake environment. A second fishpass was installed in 1979 allowing for increased passage capacity during peak migration periods.

Since 1956, enumeration of adults and sampling for age, weight, and length has been conducted at the Frazer fishpass. Spawning surveys have been performed since 1964. Annually, smolt migration timing and magnitude, zooplankton density and community composition, and limnological characteristics are measured.

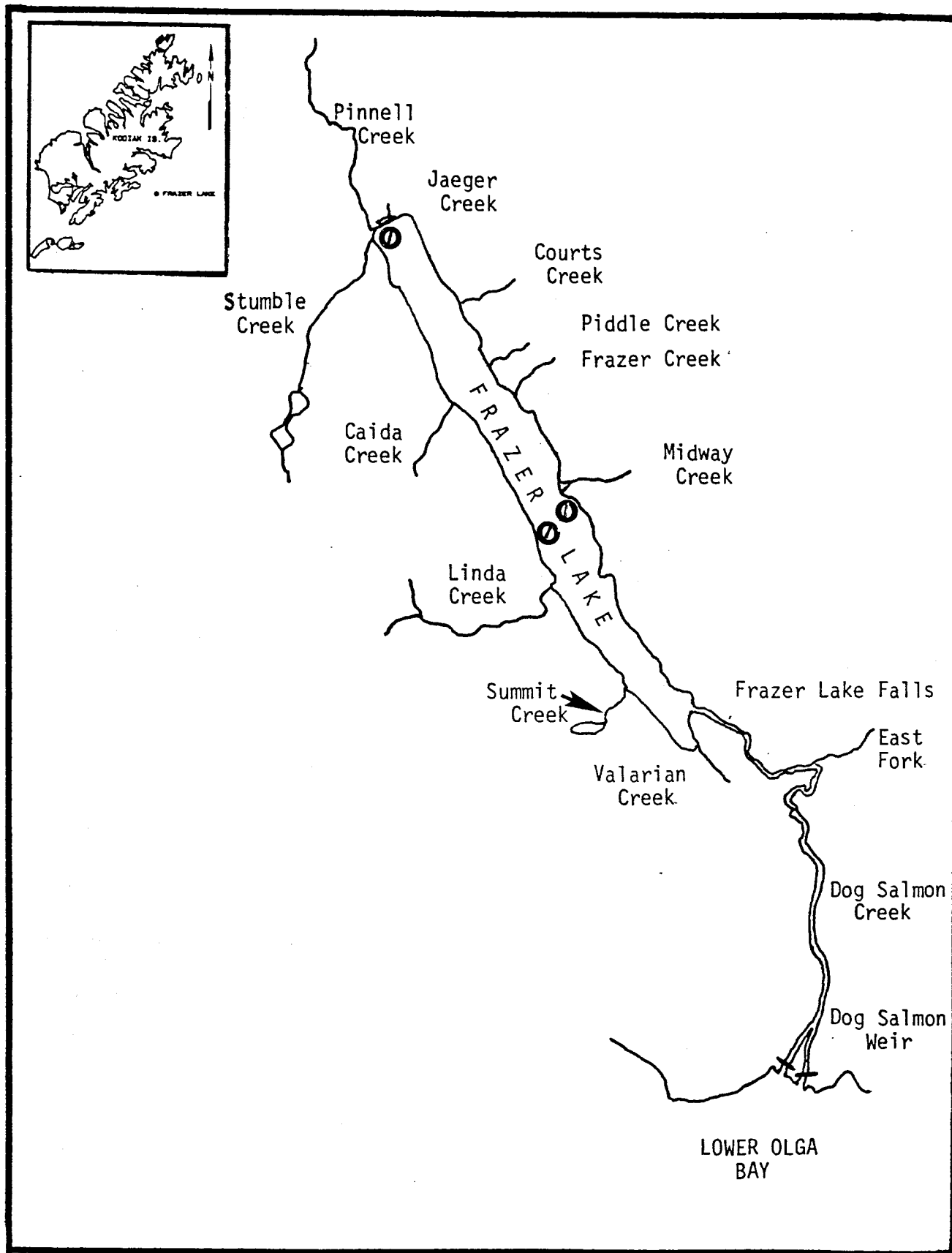


Figure 1. Map depicting Frazer Lake inlet streams and littoral beach seining sites.

Conservative fishery management practices have been very successful at building this run (1970-1985) from 25,000 in 1971 to 645,739 fish in 1985. Blackett (1975) established an escapement goal of 383,000 adults based upon limnological and spawning habitat calculations. Subsequent declines in smolt condition factor, and shifts in zooplankton size and community composition caused Kyle, Koenings, and Barrett (1986) to reduce the target escapement goal to 140,000-200,000 adults. The Frazer sockeye run in 1990 was 1,007,666 fish, comprised of a 753,126 fish harvest (valued at \$5.7 million dollars) and a 254,540 fish escapement. This run has also provided an enhanced food resource for the local Kodiak brown bear population, stimulating increases in bear densities along Frazer Lake and Dog Salmon Creek streams.

In 1986, ADF&G Fisheries Rehabilitation and Enhancement (FRED) Division transferred operation of the Frazer fishpass facility to the Commercial Fisheries Division which now operates the program. FRED Division since 1988 has applied fertilizer (mixture of Nitrogen and Phosphorous) to the lake hoping to stimulate survival of lake rearing sockeye fry. This program was instituted in response to the dramatic declines in smolt size and weight resulting from excessive escapements which occurred in 1982 and 1985.

During 1983 a second weir was installed on Dog Salmon Creek 0.7km upstream from lower Olga Bay to provide more timely sockeye and pink salmon (*Oncorhynchus gorbuscha*) escapement counts relevant to managing the commercial fishery. Weir personnel also enumerate chinook (*Oncorhynchus tshawytscha*), coho (*Oncorhynchus kisutch*), chum (*Oncorhynchus keta*), steelhead and rainbow trout (*Oncorhynchus mykiss*), and dolly varden char (*Salvelinus malma*).

OBJECTIVES

The Commercial Fisheries Division's goal for the Frazer Lake project is optimizing natural sockeye production, and collection of data relevant to generating accurate pre-season forecasts. For 1991 specific tasks are:

1. Determine sockeye smolt abundance, timing, age composition, length and weight at age.
2. Provide unobstructed and timely adult fish passage into the lake environment.

3. Determine escapement timing, magnitude, and spawner distribution.
4. Collect age, sex, and length data from adult sockeye escapements.

SUPERVISION

The project leader is Charlie Swanton with Jean White and Tom Rivest being Crew leader and assistant, respectively. Jean is responsible for scheduling daily work assignments, assuring collected data adheres to plan standards, and that safety is priority. A brief chronology of assignments is presented (Table 1). The addition of a brown bear viewing program by the U.S. Fish and Wildlife Service (USFWS), has added support of a federal seasonal technician whose primary responsibility is field operations for bear viewing participants. This person will cohabitate with Jean and Tom whose charge is fishpass operations and collection of biological data. All three field personnel will to some extent assist with USFWS and ADF&G oriented duties, however, their priorities are specific to agency. Jean White will supervise care, maintenance, and routine cleaning tasks of ADF&G living quarters and associated grounds. Jean is also responsible for rectifying (on site) problems resultant from the bear viewing program which impinge upon normal functioning of the fish ladder, weir, and biological data collection.

Table 1. Season summary of events

Date	Event	Frequency
5/13	Open camp	
5/15-8/24	Camp and equipment maintenance	as needed
5/15-6/15	Fishpass maintenance	as needed
5/15-7/15	Sockeye smolt enumeration sample mark and recapture	2-4 times daily 70/day 6 days/week 1,000 weekly
6/15-8/25	Adult sockeye enumeration sample	daily 240 weekly
5/16-8/15	Fry seine and sample	25/species weekly 3 sites on the lake
7/15-8/25	Foot surveys	10 streams weekly
7/24-8/21	Aerial surveys Lake shoals Pinnell Creek	2 times/season 2 times/season
8/25	Close camp	

PROCEDURES

Smolt Sampling

The smolt program has two components, abundance estimation and age and weight sampling. Abundance will be derived using catches from two traps (concrete and inclined plane) operated from 15 May-15 July. Each trap will be checked every thirty minutes each night and catch enumerated by species, recorded (Figure 2), and released. Trap catch efficiency will be generated from mark-recapture experiments using Bismark brown-Y dye. The sample size for marked fish is 1000 smolt collected (optimally in a single night) over a maximum of two days. Smolt selected for dying from both traps should be proportional to catch from each trap (e.g. 500 catch from concrete, and 300 from inclined plane, then 312 are dyed from concrete and 112 from inclined plane). Transporting smolt will be via tractor and dyed smolt are to be released evenly spaced across the stream at a site providing suitable cover. All dyed smolt prior to release are to be held for approximately 30 minutes and closely scrutinized for abnormal behavior, any smolt which show signs of stress will NOT be released. The dyed fish total recorded should reflect only those fish which were actually released. All catch data of marked and unmarked fish will be recorded separately for each trap (Figure 3).

DAILY SMOLT TRAP CATCH REPORTING FORM

TRAP TYPE: _____ DATE: _____

Time (Military)	Sockeye		Coho Fry	Dolly Varden	Stickleback	Other	Comments
	Smolt	Fry					
TOTAL							

Figure 3.

SOCKEYE SALMON SMOLT SUMMARY REPORT

PROJECT LOCATION: _____

DATE (Day, Month, Year)	TOTAL # SMOLT CAUGHT	TOTAL # SMOLT MORT.	TOTAL # DYED SMOLT RELEASED	TOTAL # SMOLT EXAMINED FOR MARKS	TOTAL # DYED SMOLT RECAPTURED

Smolt age, weight, and length sampling will be proportional to catch from each trap with 70 smolt per day sampled for six consecutive days, and a dye test conducted on the seventh day. If total catch for both traps are less than 70 fish, all smolt will be sampled. Data will be recorded on standard AWL forms consecutively numbered corresponding to slides. Microscope slides will have scales from five fish aligned in rows and separated so that ageing is possible. Blank slides and AWL forms will be used for each day of sampling. Jean White is responsible for aging all smolt scales collected, however aging will not commence until after Jean has been trained by the project leader (approximately 3 July).

Escapement passage

The old fishpass will be operated from approximately 15 June-21 August, with the starting date scheduled to minimize smolt passage through the fishpass. Commencement of fishpass operations will occur the day after sockeye are first counted through Dog Salmon weir. New fishpass operation will proceed only when greater than 30,000 sockeye per day are passed through the old fishpass, therefore preventing unnecessary fish buildup. Prior to new fishpass operation, a plywood entrance chute will be installed. Diversion weirs above and below the Frazer falls will be inspected daily for holes, and cleaned when required. Specific instructions

for fishpass maintenance and operation are provided (Appendix A). The fishpass entrance bulkhead will be suitably modified if the new entrance chute gates prove ineffective; astroturf padding installed on the bulkhead will minimize fish mortality.

Escapement counting frequency will be scheduled to minimize migration delay. Specifically, counts will be made at least four times daily, and during peak escapement with increased frequency. Individual counts by species will be recorded using hand-held tally counters and data recorded (Figure 4). A standard escapement counting and sampling day will extend from Sunday to Sunday (statistical week).

Escapement Sampling

Sockeye escapement age, length, and sex sampling will be conducted weekly (statistical week) over a two day period. Sample size per week is 240 fish (Table 1). If possible collect the sample during a single day, but do not extend beyond two consecutive days even if fewer than 240 samples have been collected. Procedures for collecting and recording ALS data are given (Appendix B).

Figure 4.

ALASKA DEPARTMENT OF FISH AND GAME
KODIAK MANAGEMENT AREA
WEEKLY SALMON WEIR CAMP REPORT FOR YEAR: _____

WEIR CAMP										WEEKLY REPORT									
NAME: _____					PERSONNEL: _____					NO: _____					FOR WEEK ENDING (SATURDAY) _____				
DATE	DAILY TOTAL SALMON ESCAPEMENT					DAILY TOTALS	JACK REDS		STEELHEAD		DOLLYS UP	GILLNET MARKED		H ₂ O LEVEL		H ₂ O TEMP.	WEATHER		
	KINGS	REDS	COHO	PINK	CHUMS		NO.	%	DOWN	UP		REDS	OTHER	UP	DN		CEIL.	VIS.	WIND DIR./SPEED
SUN D																			
SUN A																			
MON D																			
MON A																			
TUE D																			
TUE A																			
WED D																			
WED A																			
THU D																			
THU A																			
FRI D																			
FRI A																			
SAT D																			
SAT A																			
TOTAL FOR WK _____																			
ACCUM. THRU WK _____																			
WEIR MORTS. FOR WK _____																			
TOT. ACCUM. _____																			
AWL SAMPL. FOR WK _____																			
TOT. ACCUM. _____																			
ADDITIONAL COMMENTS: (BEAR AND PEOPLE PROBLEMS: SMOLT MIGRATION: WEIR PROBLEMS: CABIN REPAIR: NOTE AIRCRAFT TRAFFIC																			

COMMENTS

COMMENTS

COMMENTS

Escapement stream and lake surveys

The primary objective of lake and stream surveys are to document distribution and abundance of sockeye within stream and lake shoal areas. Surveys will be conducted weekly from 15 July-21 August with Linda, Midway and Stumble creeks being priority. Streams will be surveyed to the upper limits of spawner distribution and recorded (Figure 5). Additionally, spawner limits will be noted on U.S geological survey topographic maps for each stream. Stream mouth counts will be recorded separate from actual stream counts. Observers will survey on foot and enumerate live and dead sockeye using polarized glasses, and tally counters. Before conducting surveys, tally counters will be inspected for proper functioning. Pinnell Creek and the Lake shoals will be surveyed separately using fixed wing aircraft and coordinated by the project leader, scheduled for 24 July and 21 August.

Rearing fry and limnological sampling

Three Lake littoral sites will be sampled using a 16.6 meter fry seine biweekly from 16 May-15 August. Specific sites are identified with metal fence posts and are depicted in Figure 1. A single seine set will be made at each station between

Figure 5.

SOCKEYE SALMON STREAM SURVEY LOG

[illegible]

1000 and 1400 hours, in an attempt to minimize diurnal influence in catches. Catch will be recorded by species (Figure 6) and 25 fish of each salmon species caught, measured for length (tip of snout to fork of tail), and data recorded.

MAINTENANCE AND BUILDING PROJECTS

The sauna, smolt and storage sheds located on the lower bank of the falls, will be removed and relocated on a time available basis prior to onset of adult escapement operations. The sauna and storage sheds will be rebuilt on top of the hill adjacent to the main facilities. These projects will be scheduled such that no compromise in data collection or escapement counting occurs.

CREW LEADER REPORTS

A biweekly summary of daily activities written by the crew leader and inclusive of smolt studies, adult escapement counts and sampling will be forwarded to the project leader. Adult escapement samples (AWL and scale cards) will be

Figure 6. Seine catch log

Lake: _____ Time: _____ Remarks: _____

Date: _____ H2O temp: _____

Location: _____

Seine length: _____ Crew: _____

Total Catch

Sockeye _____ Coho _____ Dolly V. _____ Stickle. _____ Rainbow _____ Other _____

Length Sample

	Sockeye	Coho	Dolly V.	Stickleback	Rainbow
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
20					
21					
22					
23					
24					
25					

forwarded to the Kodiak office biweekly. Smolt samples and associated forms will be held until after aging is completed. A seasonal summary report will be prepared inclusive of all activities and suggestions for the following season. An inventory of on site equipment and needed supplies for the following season should be included.

APPENDIX A
Fishpass Maintenance and Operation

Initial maintenance of the fishpass will be completed prior to 1 June to insure proper functioning of the facility.

Maintenance consists of:

1. Thorough inspection of the fishpasses for structural damage.
2. Replacement of broken/missing tank covers.
3. Cleaning of debris from fishpass tanks and runs.
4. Attachment of rubber bumpers on ends of fishpass and inside tanks.
5. Regrouting of fishpass where needed.
6. Cleaning entrance tanks, installation of wings and attachment of astroturf mats.
7. Clearing rocks and streambed materials from exit tank, channel, stop-log base of water control weir, and entrance tanks.

Fishpass opening procedures:

1. Wood drain plugs inserted from inside tanks into drain holes. Plugs should fit tightly, so that internal tank water pressure holds plug in place. Install tank caps screwed on from outside.

2. Tank covers positioned and stop-logs removed slowly from exit tank. Bottom stop-log remains in place. Note that if stop-logs are removed rapidly gravel is deposited into tank.
3. Make sure no holes are present where fish could escape uncouneted.
4. Install heavy guage vinyl wire across front of water control wier which prevents fish from washing over falls, attach so that screen is secure on substrate and does not lift off bottom.

The fishpass will be operated so that steeppasses are $2/3$ - $3/4$ full of water. This volume is necessary to attract sockeye to the entrance tank and promote optimum fish passage. A water level of 1.8-18.2 feet (54.86-55.47cm) should be maintained on the staff guage by removing or placing stop logs at the water control diversion (top of falls). At this level the old fishpass will be $3/4$ - $4/5$ full and new fishpass $2/3$ - $3/4$ full.

A 9-inch (22.86cm) wide vertical slot "door" is placed at the entrance tank during most of the annual sockeye run. This door will be checked daily during fish passage to assure it is completly closed. It can open when sockeye hit against it, so diligence is necessary. The opening space (22.86cm) is needed to maintain

velocity for fish attraction. The door can be opened to 1 foot (30.48cm) at seasons end to further attract fish.

The fishpass will be checked daily for cover tightness and unobstructed water flow. Under no circumstances should obstructive materials be placed in the exit tank or steepass.

Avoid allowing detergents or chemicals from entering the fishpass water supply. Visitors and all other personnel will not be allowed on the fishpass nor interfere with salmon passage.

Fishpass closing procedures (approximately 25 August):

1. Remove counting trap and screen and store on stream bank. Place wood blocks under logs and wood frame parts, preventing ground contact and potential rot.
2. Remove stop-logs from water control weir and stack on bank, replace stop-logs in exit tank. Visqueen as necessary to stop water flow between logs.
3. Remove all drain caps by unscrewing and lightly tapping them from outside tanks, store caps and plugs in tractor shed. All water should be

drained from tanks. All residual materials within tanks should be removed.

4. Remove vertical slot door and store in tractor shed.
5. Inspect fishpass and facility for needed repairs and list including inventory, and needed materials in the daily log/annual report. Also include fuel caches and propane ect. so that we know what is left behind.
6. When lower weir is removed, panels will be stored on the lower stream bank. Bolts on the weir should be tightened and replaced if necessary. Catwalk and stringer materials should be inspected and replaced if required. Add lumber needs to materials list.

APPENDIX B
Adult Sampling Procedures

INTRODUCTION

Annually, sockeye salmon escapements are sampled for age, length, and sex from major and minor systems by field personnel within the Kodiak Management Area. Management and research biologists rely on this data for forecasting, escapement goal evaluation, catch apportionment, and run timing estimation. As the demand on our salmon resource increases, so does the intrinsic value of this data.

During the last several years, stock identification projects using scale pattern analysis have been conducted within the Alitak, Afognak, and Mainland Districts. The foundation for these projects are the scale samples that you collect. It is imperative that scales collected be of the highest quality possible.

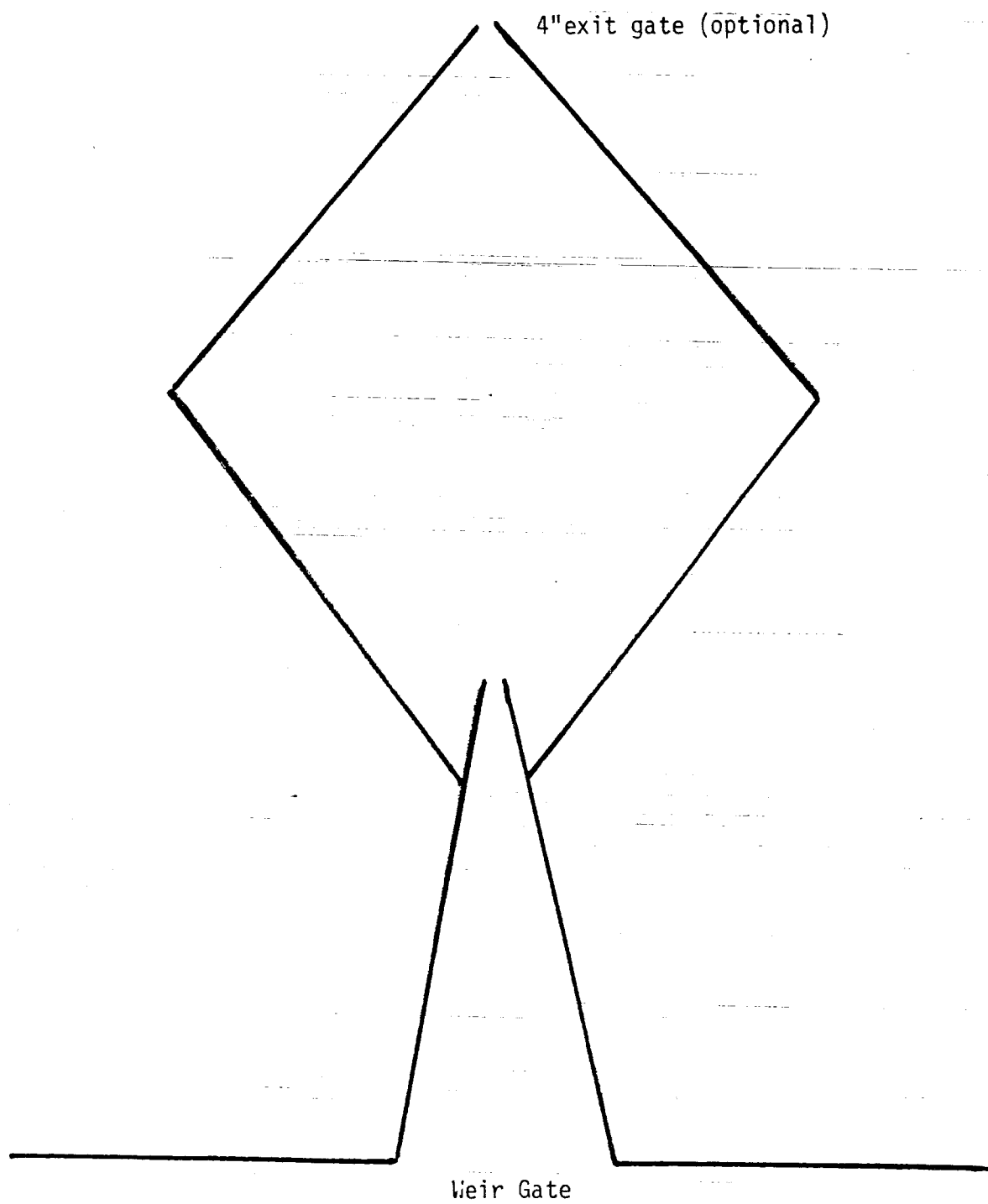
The Opscan (AWL form scanner) machine does not allow for blanks, partially filled in sections or correction of errors present on the AWL forms. No one can collect the preferred scale or fill out AWL forms correctly but you. Several minutes of quality control during and immediately after the sampling event can literally save days of editing in the office.

It is the crew leader in conjunction with the field crew's, responsibility to complete the sampling tasks, assure quality of scales, and data recording prior to samples being sent to town. If quality is not maintained it may be necessary to either increase sample size or rotate crew members.

If questions or difficulties arise with regard to samples or proper procedures to follow for your specific location, please do not hesitate to contact Pat Holmes (Management) or Charlie Swanton (Research).

We can anticipate problems surrounding the large pink salmon run predicted to return from the 1989 escapements for several weir sites; any innovative ideas with reference to sampling or changes in the trap design will always be highly regarded (Figure.1). However, make sure that consistency between sampling weeks is maintained (i.e. no selection based upon sex, size, or coloration occurs). Your assistance and dedicated effort in collection of this valuable information is always appreciated.

Figure 1. The "Scott" six panel salmon trap.



OBJECTIVES

1. Determine age, length at age, and sex composition of selected sockeye escapements within the Kodiak Management Area. Similarly collect data for coho salmon escapements.
2. Results will be published in a Regional Information Report by C. Swanton.

SUPERVISION

Kodiak Area management staff Pat Holmes, Kevin Brennan, and Dave Prokopowich will oversee escapement sampling at all weir projects except Frazer and Akalura. Pat Holmes will monitor weekly escapement sampling and review incoming data for completeness, and scale mounting technique. Patricia Roche will fill Pat's role during absences. Weir crew leader's and the Area Biologist will be notified regarding data quality.

A log book will be maintained concerning the quality of sampling and compliance with the sampling schedule. This documentation will be included in individual personnel evaluations.

PROCEDURES

Weekly, weired sockeye systems (Uganik, Karluk, Upper Station, Ayakulik) will be sampled for age, length and sex (ALS) (Figure. 2, Table 1). A total of 240 fish per week will be collected on the 5th day (Thursday). If the required number of fish are not taken within a single day, obtain the balance of the sample on the following day (Friday). Notify the office if sampling difficulties occur that require changing this schedule. The crew leader will notify Dave Prokopowich or Kevin Brennan via SSB radio upon completion of weekly sampling. Completed ALS data from Karluk weir will be mailed to Kodiak (return receipt from the post office) and the office notified of mailing date.

Afognak weir personnel will collect 600 samples from both early and late sockeye run components. A single 600 fish sample will be collected at the Saltery weir during the peak escapement. Personnel will notify Pat Holmes if assistance with sampling is necessary.

Minor systems will also have escapement samples collected but with reduced intensity. The Pauls Lake staff will collect three 240 fish samples during the peak escapement period. If sampling at the weir is unfeasible, a 600 fish sample will be collected using a beach seine at the stream mouth or lake. A single 240 fish sample will be obtained by Sport Fish Division personnel for Buskin Lake

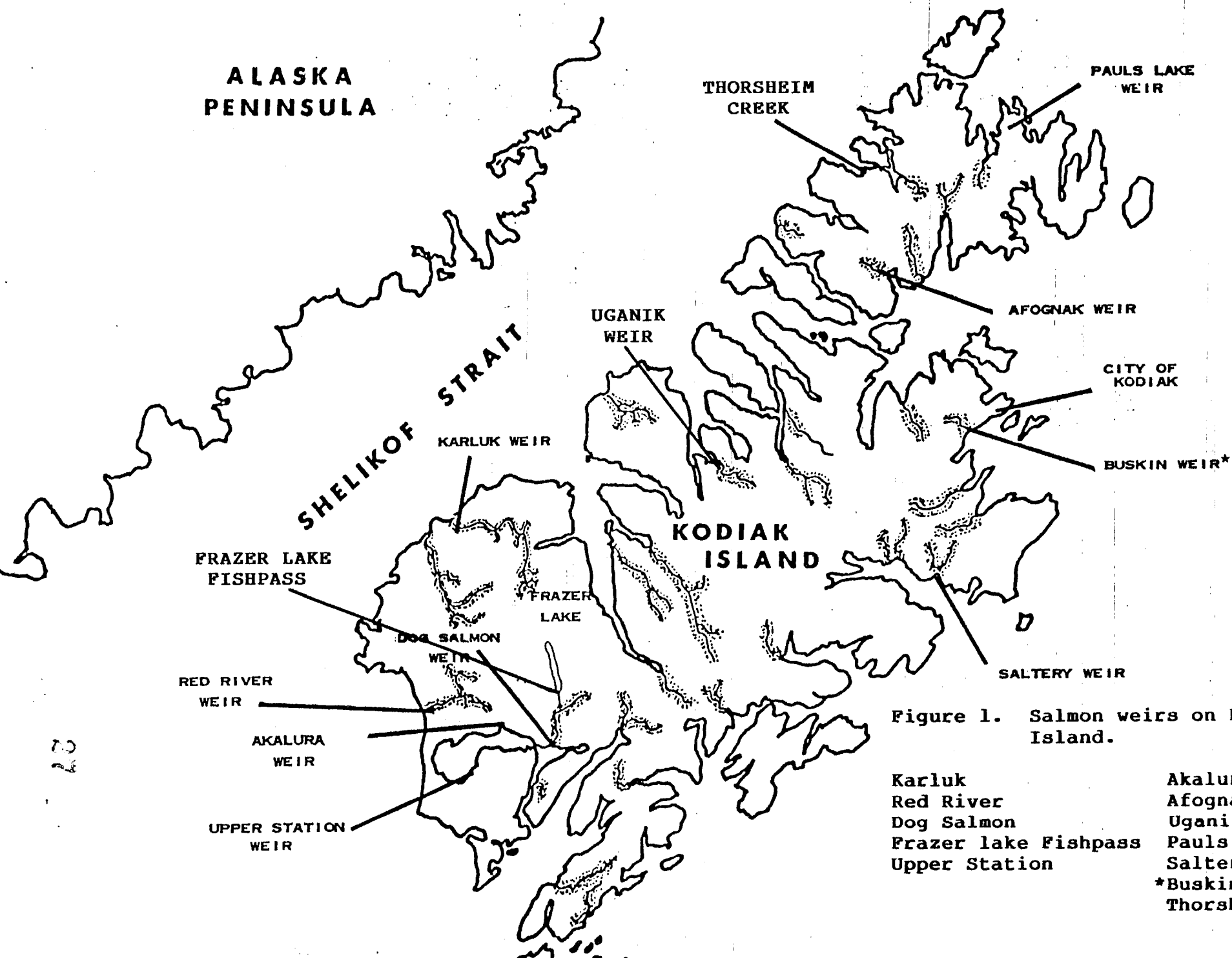


Figure 1. Salmon weirs on Kodiak Island.

Karluk
Red River
Dog Salmon
Frazer lake Fishpass
Upper Station

Akalura Lake
Afognak River
Uganik River
Pauls Lake
Saltery River
*Buskin River
Thorsheim

Table 1. Sockeye salmon escapement sampling schedule, 1991.

Location	Sampling Frequency	Statistical Week		Sample Size
		Starting	Ending	
Karluk weir	weekly	23	40	240
Red River	weekly	23	40	240
Upper Station	weekly	23	40	240
Afognak weir (early)	once	24 or 25		600
Afognak weir (late)	once	29		600
Little River Lake	once	24		600
Uganik Lake weir ^a	weekly	23	40	240
Saltery River weir	once	28 or 29		600
Buskin Lake weir ^b	once	27 or 28		240
Pauls Lake weir	weekly	24	26	240
Kaflia Lake	once	28 or 29		600
Malina Lake	once	28 or 30		600
Thorshiem Creek ^c	once	27 or 28		600

^a Sampled by USFWS.

^b Sampled by Sport Fisheries Division?

^c Sample may be obtained from the terminal catch.

at the escapement peak. Pat Holmes will be responsible for collecting 600 fish samples from Little River, Malina, and Kafkia Lakes at or near peak escapement. David Kaplan and Chris Hicks will be responsible for collecting a 600 fish sample from Thorshiem (either from the escapement or terminal seine catch).

Coho escapement samples will be collected at Karluk, Ayakulik, Upper Station, Saltery, and Uganik River weirs. A total of 280 coho will be sampled (two scales per fish) at each location within a 10 day period during peak escapement. Pat Holmes will provide assistance at Saltery weir if requested. Sport Fish Division will sample 150 fish at or near peak escapement for the Buskin River.

It is essential that all ALS data be representative of the true escapement, therefore avoid bias by: NOT pre-selecting fish based upon size, sex, condition or any other factor. Data collection and recording procedures are presented in Appendices A and B. Sampling schedules defined by statistical week (Table 2) for 1991 are given in Table 1.

The following appendices provide an explanation of how samples should be collected. If you have not collected scales before, or if you have any questions ask Pat Holmes or Charlie Swanton to demonstrate the procedure. Scales must be readable and data must be recorded accurately to be useful.

SAMPLING SCENARIOS:

1. Differing size crews:

a. One person:

Wrestle the fish into the measuring board, wearing a glove on one hand. Measure and sex the fish. Remove a glove, pluck the preferred scale with the clean hand, release the fish, clean and mount the scale on the gum card in the card holder (which is kept in a protected place). Record the sex and length on "rite-in-the-rain" book or tape recorder (transfer the data to the AWL after sampling). A slime rag may be helpful.

b. Two persons:

One person can wrestle the fish while the other records the data, plucks and mounts scales.

c. Three persons:

One person wrestles the fish, one plucks and mounts the scales, and the third records the data.

Table 1. Sockeye salmon escapement sampling schedule, 1991.

Location	Sampling Frequency	<u>Statistical Week</u>		Sample Size
		Starting	Ending	
Karluk weir	weekly	23	40	240
Red River	weekly	23	40	240
Upper Station	weekly	23	40	240
Afognak weir (early)	once	24 or 25		600
Afognak weir (late)	once	29		600
Little River Lake	once	24		600
Uganik Lake weir ^a	weekly	23	40	240
Saltery River weir	once	28 or 29		600
Buskin Lake weir ^b	once	27 or 28		240
Pauls Lake weir	weekly	24	26	240
Kaflia Lake	once	28 or 29		600
Malina Lake	once	28 or 30		600
Thorshiem Creek ^c	once	27 or 28		600

^a Sampled by USFWS.

^b Sampled by Sport Fisheries Division?

^c Sample may be obtained from the terminal catch.

Table 2. Statistical weeks and corresponding calendar dates for 1991.

Statistical Week	Calendar Dates	Statistical Week	Calendar Dates
1	01-Jan to 05-Jan	28	07-Jul to 13-Jul
2	06-Jan to 12-Jan	29	14-Jul to 20-Jul
3	13-Jan to 19-Jan	30	21-Jul to 27-Jul
4	20-Jan to 26-Jan	31	28-Jul to 03-Aug
5	27-Jan to 02-Feb	32	04-Aug to 10-Aug
6	03-Feb to 09-Feb	33	11-Aug to 17-Aug
7	10-Feb to 16-Feb	34	18-Aug to 24-Aug
8	17-Feb to 23-Feb	35	25-Aug to 31-Aug
9	24-Feb to 02-Mar	36	01-Sep to 07-Sep
10	03-Mar to 09-Mar	37	08-Sep to 14-Sep
11	10-Mar to 16-Mar	38	15-Sep to 21-Sep
12	17-Mar to 23-Mar	39	22-Sep to 28-Sep
13	24-Mar to 30-Mar	40	29-Sep to 05-Oct
14	31-Mar to 06-Apr	41	06-Oct to 12-Oct
15	07-Apr to 13-Apr	42	13-Oct to 19-Oct
16	14-Apr to 20-Apr	43	20-Oct to 26-Oct
17	21-Apr to 27-Apr	44	27-Oct to 02-Nov
18	28-Apr to 04-May	45	03-Nov to 09-Nov
19	05-May to 11-May	46	10-Nov to 16-Nov
20	12-May to 18-May	47	17-Nov to 23-Nov
21	19-May to 25-May	48	24-Nov to 30-Dec
22	26-May to 01-Jun	49	01-Dec to 07-Dec
23	02-Jun to 08-Jun	50	08-Dec to 14-Dec
24	09-Jun to 15-Jun	51	15-Dec to 21-Dec
25	16-Jun to 22-Jun	52	22-Dec to 28-Dec
26	23-Jun to 29-Jun	53	29-Dec to 31-Dec
27	30-Jun to 06-Jul		

SCALE SAMPLING:

Scale cards:

The scale card is a gum-backed sheet numbered 1 through forty. Scales from the sample are placed on the card with no attempt to separate the fish by sex.

Use the card holders provided to prevent the cards from getting wet during sampling. The cards must be kept dry at all times. A wet gum card may make the scales unreadable. If the weather is too bad, suspend sampling until dryer conditions prevail. When the card gets wet glue often obscures scale features and scales frequently adhere poorly to the card. In this situation the scales should be remounted on a new card. Cover the completed gum card with wax paper for storage, place the cards between two flat surfaces to prevent distortion.

A new, consecutively numbered, card is used each day, even if the previous card is not completed. Scale cards numbers must match the corresponding AWL sheet. Do not repeat the sample number during the season.

Fill out the gum cards as shown in Appendices B.1 and B.2.

Species:

Write out completely (i.e., sockeye, coho).

Locality:

For catch sampling and escapement sampling write down area in which fish were caught followed by "escapement" (i.e. Karluk River escapement).

Stat. Area and Sampling Date:

Transfer the appropriate numbers from the AWL form.

Gear:

Write out completely (weir/trap, beach seine).

Collectors:

Record the last name or initials of the person(s) sampling.

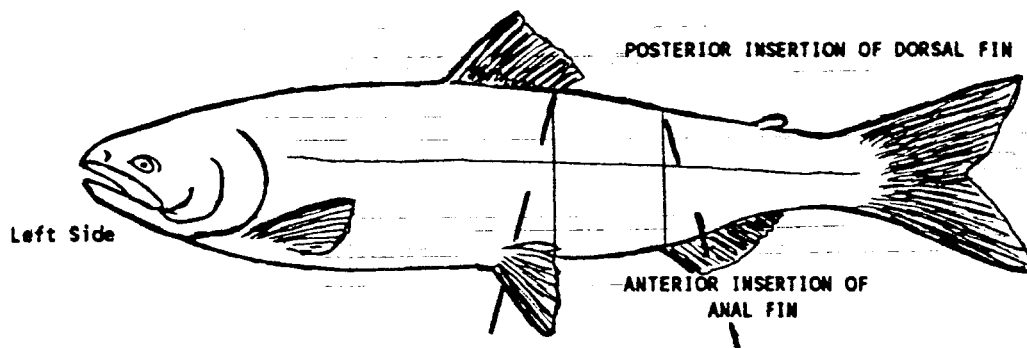
Remarks:

Record any pertinent information such as number of scales per fish sampled, factors affecting sampling, bears in the trap, difficulties sexing fish, ect. Transfer this same information to the top margin of the AWL.

Sampling:

1. Take the preferred scale if it is available, if not note that the scale taken is not preferred (error codes on AWL). The "preferred scale" is located on the left side of the fish, two rows above the lateral line on the diagonal from the posterior

Appendix A.1. Sampling procedure for the preferred scale.



Take the preferred scale on the left side of the fish, two rows above the lateral line and on the diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin.

If the preferred scale is missing take a scale again from the left (or) right side of the fish no more than four rows above the lateral line, within the preferred area, behind the dorsal fin and ahead of the anal fin.

If sampling more than one scale take the preferred scale and scale #2 and scale #3 as shown or the closest scale to that location.

PREFERRED AREA

Row 4

Row 2

PREFERRED SCALE

Note: Mount scales with the anterior portion (arches) of the scale pointed toward the tope of the card.



Place the scales directly over the number on the gum card.

10	9	8	7	6	5	4	3	2	1
20	19	18	17	16	15	14	13	12	11
30	29	28	27	26	25	24	23	22	21
40	39	38	37	36	35	34	33	32	31

insertion of the dorsal fin to the anterior insertion of the anal fin (Appendix A.1). If the "preferred scale" is missing, select a scale within the preferred area on either the left or right side of the fish. If no scales are present in the "preferred area" on both sides of the fish, sample a scale as close to the preferred area as possible and darken the 8 under age error code" on the AWL form. Do not take a scale from the lateral line they are creased and worthless for digitizing!

2. Clean the scale by wetting it and rubbing it between your fingers. Make sure no dirt, slime or skin (no silver color) remain on the scale.
3. Mount the scale on the gum card with the ridged (rough) side up. The ridged (rough) side of the scale is the same side that is exposed on the salmon.
4. Mount scale with the annular ring arches up (Appendix A.1).
5. One scale will be taken from sockeye and two scales from coho (Appendix B.1, B.2). When taking multiple scales per fish sample the "preferred scale" and second scale one inch to the left of the "preferred scale," and two rows above the lateral line. Mount the 2 scales from fish #1 over 1 and 11 on the gum card as shown in Appendix B.2. Continuing, mount the 2 scales from fish #2 over 2 and 12, etc. If sampling 3 scales, mount the scales over #1, #11, #21, etc.
6. Scales should be neat, clean, and orderly.
7. CHECK EACH SCALE FOR CORRECT MOUNTING BEFORE SENDING IT TO TOWN. A light touch with your fingernail and a visual inspection of the orientation of the arches will reveal any problems. Remount the scales if necessary.

SCALE SAMPLING CHECKLIST

Clipboard	Pencils (No.2)	Gloves
Gum Cards	Forceps	Measuring board or
Calipers	AWL's	Wax paper inserts
Sampling Manual		Plastic scale card holders

AGE-WEIGHT-LENGTH (AWL) FORMS

Data must be recorded on the mark-sense forms neatly and accurately. Keep the mark-sense forms flat, dry, and clean. Fish gurry and water curling will cause data to be misinterpreted by the optical scanning machine. The forms should be neat and legible enough to have a stranger be able to make sense out of them.

When sampling a weired system you may use "write-in-rain" books to record the data. Keep the mark-sense forms in camp where they will be clean, dry, and flat. After sampling is done for the day transfer the data to the mark-sense forms. It is the responsibility of the data collector to transcribe the data before sending the forms to the office.

A completed mark-sense AWL form and accompanying gum card for sampling sockeye is shown in Appendix B.1. A completed AWL form and accompanying gum cards for sampling coho salmon are shown in Appendix B.2.

Complete each section of the left side of the mark-sense form using a soft No. 2 pencil and darken the corresponding blocks as shown in the figures. Make every effort to darken the entire block, do not allow your marks to overlap the adjacent rows. Partially filled blocks are often missed by the optical scanner, overlapping marks on adjacent rows creates multiple numbers and error codes for the sampled fish. This causes a lot of problems for Patty Roche and Kim Phillips when they are processing the sample. Do not mark on the left hand margin of the form. Label only one form at a time to avoid "the carbon paper effect" and resulting stray marks. Do not attach any thing to the AWL with paper clips this may cause the Opscan reader to miss-feed the form.

Description:

Species/Area/Escapement i.e. Sockeye/Karluk weir/Escapement

Samplers: W-(Wrestler) Name

P-(Scale plucker) Name

R-(Recorder) Name

List any factors relating to sampling, number of scales collected, bear in the trap, difficulties sexing fish, ect.

Card:

The AWL forms and corresponding gum card(s) are numbered sequentially by date throughout the season starting with 001. A separate numbering sequence will be used for each species and geographic location. Consult your crew leader for the current card number. The number of cards varies by species; sockeye samples use one card per AWL form (Appendix B.1), coho samples require two cards per AWL (Appendix B.2).

Species:

Refer to the reverse side of the AWL form for the correct number.

Day, Month, Year:

Appendix B.1 AWL and scale cards for sampling 1 scale per fish.

Samplers W-Ted Stock
P - Steve Brown
R - Zappi Pod

Scale reader: P. Roche

DESCRIPTION: Sockeye/Karluk/Escape ment

ADFG ADULT SALMON AGE-LENGTH
FORM VERSION 2.1

CARD: 001

SPECIES: Sockeye

DAY: 3

MONTH: June

YEAR: 91

DISTRICT: 255

SUBDISTRICT: 10

STREAM: 101

LOCATION: 35

PERIOD: 23

PROJECT: SSC

GEAR: weir trap

MESH:

TYPE OF LENGTH MEASUREMENT: 2

NUMBER SCALES/FISH: 1

OF CARDS: 1

#	SEX	100's	LENGTH	1's	AGE GROUP	AGE ERROR CODE
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
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219723

Appendix B.2 AWL and scale cards for sampling 2 scales per fish.

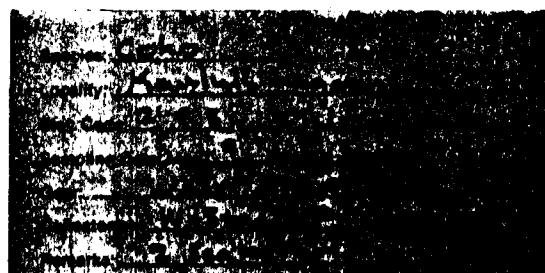
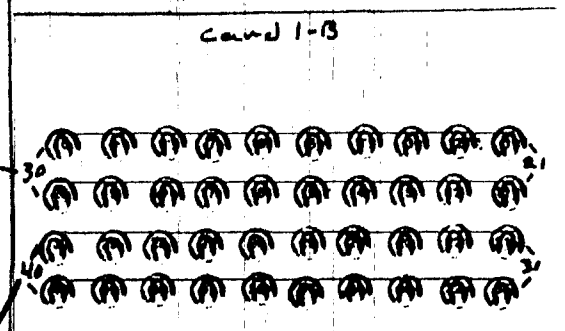
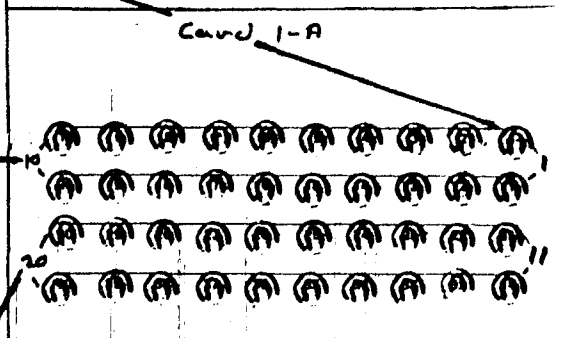
Samplers: W-T. Stack
P - S. Brown
R - J. Fox

Scale Reader: P. Roche

DESCRIPTION: Coho/Karluk/Escape ment

ADF&G ADULT SALMON AGE-LENGTH
FORM VERSION 2.1

CARD:	SEX	100's	LENGTH	1's	AGE GROUP	AGE ERROR CODE
001A,B						
SPECIES: Coho						
DAY: 15						
MONTH: Sept						
YEAR: 91						
DISTRICT: 255						
SUBDISTRICT: 10						
STREAM: 101						
LOCATION: 35						
PERIOD: 38						
PROJECT: Esc						
GEAR: Weir/rmp						
MESH:						
TYPE OF LENGTH MEASUREMENT: 2						
NUMBER SCALES/FISH: 2						
# OF CARDS						



DO NOT WRITE IN THIS MARGIN

219722

NCS DUCUSCAN MB20 17877 109 A5200

Use the date when the fish are caught.

District, subdistrict, stream number:

List only one district, subdistrict and stream number. I.e. for the Karluk weir: 255(district), 10(subdistrict), 101(stream number) Consult the Kodiak Area Statistical Area Chart for the appropriate district, subdistrict, and stream numbers. If you do not have the chart ask the Kodiak office for the correct numbers, do not leave these sectors blank.

Location:

List the appropriate code as shown on Appendix B.3. For example Karluk weir is (035).

Appendix B.3. Assigned port and weir location codes.

Port Codes

030 - Lazy Bay
031 - Port of Kodiak
032 - Pauls Lake
033 - Thorshiem
034 - Afognak River
035 - Karluk River
036 - Red River
037 - Upper Station
038 - Frazer Lake
039 - Dog Salmon
040 - Akalura River
041 - Uganik River
150 - King Cove
151 - Port Moller
052 - Dutch Harbor
053 - Akutan
054 - Sand Point
055 - Bear River, ADF&G Camp
056 - Nelson River, ADF&G Camp
057 - Canoe Bay

Period:

List the statistical week in which the fish were caught (Table 2).

Project:

Refer to the reverse side of the AWL form for the correct code for escapement sampling (3).

Gear:

Refer to the reverse side of the AWL form for the correct code (19).

Mesh:

Leave blank unless specifically instructed by supervisor to do otherwise.

Type of length Measurement:

Use (2) mid-eye to fork-of-tail, unless specifically instructed to do otherwise (Appendix B.4).

of cards:

Mark 1 when sampling sockeye and coho salmon (Appendix B.1, B.2). When sampling coho salmon write the card numbers (i.e. 001A, 001B,) as shown in Appendix B.2.

Sex:

Darken M or F in the sex columns. If any difficulty was encountered in this procedure, write "trouble sexing fish" on the top margin of the AWL and ask your supervisor for help as soon as possible before sexing additional fish.

Length:

Measure all length in millimeters from the middle of the eye to the fork of the tail, refer to Appendix B.4. Record length by blackening the appropriate column blocks on the AWL form. Column 3 on the AWL form is used for fish over 999 millimeters long. Measure all fish to the nearest mm. If you use calipers check them daily, before use, to ensure the accuracy of the measurements.

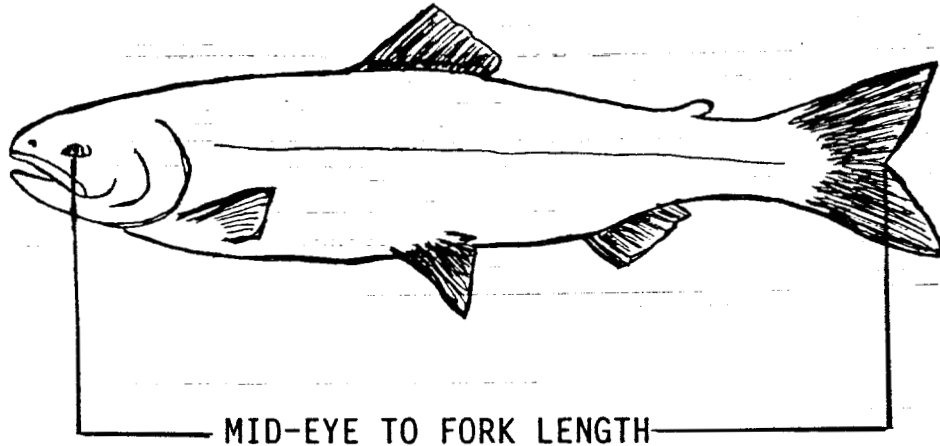
Additional data columns:

Additional data may be recorded on the back of the AWL for individual project use. If you use them and wish that data to be read by the opscan reader, you will need to transfer the litho code from the front of the form to the back. Weights, if taken, should be noted in the right hand margin of the awl when during sampling and be transferred to the back of the awl sheet. Adipose clipped fish should have the head tag number recorded on the corresponding row in the first five columns on the reverse side of the AWL. Tagged fish that are sampled should also be recorded in this manner. Note all tagged fish observed in your log book.

After editing a form, place your initials next to card #, but not in left margin.

As soon as possible after completion send the samples and --
mark-sense forms to the office in Kodiak. During scheduled radio
calls before sending the data in, the crew leader will notify the
area biologist: 1) that the data is being mailed (use a
moisture-proof container); 2) what data is being sent; 3) when
delivery is expected in Kodiak; and 4) who is transporting the
data. It is important that these steps are followed to ensure
delivery.

Appendix B.4 Measuring fish length, mid-eye to fork of tail.



Mid-eye to fork lengths are taken because the length and shape of a salmon's snout changes as it approaches sexual maturity. The procedure for measuring by this method follows:

- 1) Place the salmon flat on its right side, with its head to your left and the dorsal fin away from you.
- 2) The eye should be on the line projecting from the end of the meter stick. Hold the head in place with your right hand. Sometimes you can control the fish better by placing your thumb in the fish's mouth.
- 3) Flatten and spread the tail against the board with your right hand.
- 4) Read the mid-eye to fork length to the nearest millimeter.

Reminders

- 1) AWLs should be carefully edited. Re-check header information on AWLs; make sure all available information is filled in. Take extra care to use the correct statistical week for the sampling or catch date. Page numbers should not be repeated; a frequent error is to begin a week's sample with the last page number used the week before. Take time to ensure that the boxes are being blackened correctly. Keep marks within each rectangle and completely fill them. After AWLs are edited, place editor's initial next to page number, but not in left margin. Before sending data forms in, look down the form from two angles to pick up any glaring mistakes.
- 2) Mount the scales correctly, with anterior end (arches up) toward top of scale card with the ridged (rough) side out.
- 3) Make sure the error codes are correct. Error code 7 is wrong species, error code 8 is non-preferred scale. Error code 6 is for the use of the scale reader, it refers to the reabsorption of the scale.
- 4) Transfer important comments from scale cards to AWLs. Important remarks can be lost; after pressing scales, the cards are seldom referred to again. Write comments in the top margin (not on the left side). If there is not room on the AWL to completely explain the remarks, use a separate piece of paper.
5. Never put data from different dates on one AWL or one scale card. Even if only one scale is collected that day, begin a new card and AWL for the next day.
6. If weights are taken be sure to transfer the weights to the appropriate columns on the reverse of the AWL before submitting it to the office.
7. If possible Keep the litho code in order. The data processing program uses the "litho code" to track the data files. (It is located in the lower left margin of the AWL.) Keep them in order if before numbering the pages.
8. Recopy all wrinkled or splotched AWLs before sending them in. The optical scanning computer will misread, reject, or destroy damaged sheets.

The responsibility for accuracy lies first with the primary data collector(s). Sloppy or incomplete data will be returned to individual collectors. Compliance with the sampling procedures and schedule will be noted in each samplers evaluation.

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